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National Aeronautics and Space Administration

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Scientific and Technical Aerospace Reports

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Includes administration and management; space law and related legal matters; legislative hearings and documents; and symposia or conferences of a broad or general nature.

N64-22734 Joint Publications Research Service, Washington, D.C.
TRANSLATION ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 91
Shen Hsien-Lun et al 15 Jun. 1964 37 p refs Transl. into ENGLISH from Chinese Periodicals
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In AGARD Proc. of the 13th AGARD Gen. Assembly [1963] p37–50 In FRENCH (See N64-22870 16–10)

This article deals with the establishment, concepts, and experiences of missile testing ranges in France. The various test sites are described as to methods used, location, equipment installed, and specialized missions. G.D.B.

N64-22876 Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 87
26 May 1964 51 p refs Transl. into ENGLISH of Selected Articles from K'o-Hsueh T'ung-Pao (Peiping), no. 1, 1964, p 27–48, 343–344
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N64-23001 Joint Publications Research Service, Washington, D.C.
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25 May 1964 31 p refs Transl. into ENGLISH from K'o-Hsueh T'ung-Pao (Peiping), no. 1, 1964 p 56–64, 78–81
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N64-23014 Congress House Committee on Science and Astronautics

INVESTIGATION OF PROJECT RANGER

Homer E. Newell et al Washington, GPO, 1964 799 p Hearings before Subcomm. on NASA Oversight, 27, 29, 30 Apr; 4 May 1964

(88th Congr., 2d Sess., no. 3, Comm. Print)

The House Committee on Science and Astronautics held extensive hearings on Project Ranger to determine its status and problems. These are the published verbatim transcripts of these hearings, heavily documented with charts, illustrations, and technical information on the project. G.D.B.

N64-23066 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

BULLETIN OF HIGHER EDUCATIONAL INSTITUTIONS (SELECTED ARTICLES)

30 Sep. 1963 189 p refs Transl. into ENGLISH from Izv. Uchebn. Zavedeniy, Aviats. Tekhn. (USSR), no. 3, 1961 p 3–30, 38–68, 89–99, 113–180

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N64-23093 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PROBLEMS IN DEVELOPMENT OF GLASS AND PORCELAIN INDUSTRY

28 May 1963 19 p refs Transl. into ENGLISH of 2 Articles from the Book "Voprosy Razvitiya Stekol'noy i Farforo-Fayansovoy Promyshlennosti" Izd. Akad. Nauk Ukrain. SSR, 1962 p 47–54, 188–190

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N64-23151 Defense Dept., Washington, D.C. Office of the Director of Defense Research and Engineering

SHOCK, VIBRATION AND ASSOCIATED ENVIRONMENTS, PART IV Bulletin No. 33

Nav. Res. Lab., Mar. 1964 242 p refs Papers Presented at the 33rd Symp. on Shock, Vibration and Associated Environments, Washington, D.C., 3–5 Dec. 1963

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19. VIBRATIONAL ENERGY LOSSES AT JOINTS IN METAL STRUCTURES E. E. Ungar (Bolt, Beranek and Newman, Inc.) p 189–199 refs (See N64-23162 16-33)

20. DESIGN OF SPACE VEHICLE STRUCTURES FOR VIBRATION AND ACOUSTIC ENVIRONMENTS C. E. Lifer (NASA. Marshall Space Flight Center) p 201–207 refs (See N64-23163 16-33)

21. SUMMARY OF DESIGN MARGIN EVALUATIONS CONDUCTED AT THE U.S. NAVAL MISSILE CENTER C. V. Ryden (Naval Missile Center) p 209–217 refs (See N64-23164 16-34)

22. PANEL SESSION: THE USE OF ENVIRONMENTAL DATA IN DESIGN J. C. Burgess (United Technol. Center) p 219–227

N64-23316 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TRANSACTIONS OF THE SEMINAR ON HEAT-RESISTANT MATERIALS (SELECTED ARTICLES)
12 Feb. 1962 99 p refs Transl. into ENGLISH from Tr. Seminara Po Zharostoykim Materialam, no. 4, Izd. Akad. Nauk Ukr. SSR (Kiev), 1959 p 38–64, 96–115
(FTD-TT-62-1252/1+2; AD-400515)

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1. AN INVESTIGATION OF WETTING OF THE SOLID SURFACES OF CERTAIN HIGH-MELTING COMPOUNDS BY MOLTEN METALS V. N. Yeremenko and Yu. V. Naydich p 1–22 refs (See N64-23317 16-13)

2. MAXIMUM GAS-BUBBLE PRESSURE METHOD AS APPLIED TO DETERMINATION OF SURFACE TENSION OF METALS OF THE IRON FAMILY V. V. Fesenko and V. N. Yeremenko p 23–44 refs (See N64-23318 16-18)

3. INFLUENCE OF ASH-FORMING COMPONENTS IN LIQUID FUEL ON DETERIORATION OF GAS-TURBINE MATERIALS R. F. Mocharnyuk p 45–64 refs (See N64-23319 16-26)

4. COMPARATIVE INVESTIGATION OF EROSION RESISTANCE OF HIGH-TEMPERATURE CORROSION-RESISTANT MATERIALS OF GAS TURBINES OPERATING ON SOLID FUEL K. V. Olesevich p 65–75 refs (See N64-23320 16-26)

N64-23327* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MOTIVATION OF TECHNICAL PERSONNEL
Michael J. Vaccaro N.Y., AIAA [1964] 7 p Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964 (AIAA Paper-64-407) AIAA: $0.50 members, $1.00 nonmembers

This paper is concerned with a human-relations investigation of a group of aerospace research and development general-management and project-management personnel to ascertain the following: (1) which motivational elements served as stimulators and which served as dissatisfiers; and (2) to what extent did the provision by the Government of an incentive contract serve to assist these organizations in establishing the climate for attracting and retaining technical personnel. N.E.A.

N64-23395 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ASTRONAUTICS (SELECTED CHAPTERS)
Mieczyslaw Subotwicz 26 Nov. 1963 210 p Transl. into ENGLISH from the Book "Astronautyka" Warsaw, Panstwowe Wydawnictwo Naukowe, 1960 p 20–36, 95–161, 192–203, 379–396, 460–463, 474–486
(FTD-TT-61-123/1+2+3+4; AD-427257)

CONTENTS:

1. SPACE FLIGHT AND EXISTING POSSIBLE FORMS OF PROPELLANT p 1–9

2. NEWTON'S THIRD LAW OF MOTION AND THE LAW OF THE CONSERVATION OF MOMENTUM, EQUATIONS OF ROCKET MOTION p 10–26

3. NUCLEAR FUELS p 27–91

4. MAGNETOHYDRODYNAMIC PROPULSION (MHD). PLASMA ENGINES p 92–134

5. REMOTE-CONTROL PROBLEMS IN ROCKETRY p 135–153

6. PRACTICAL PROBLEMS ENCOUNTERED IN ORBITING ARTIFICIAL SATELLITES p 154–181

7. A METHOD TO MEASURE COORDINATES AND DETERMINE THE ORBIT OF A SPACE VEHICLE IN INTERPLANETARY SPACE p 182–204

N64-23442 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PLANET, PHYSICS, MANKIND
M. Pasechnik 6 Jan. 1964 10 p Transl. into ENGLISH from Pravda Ukrainy (Kiev), 1 Aug. 1961 p 3
(FTD-TT-63-1148/1; AD-429451)

Atomic energy can be produced in one of two ways—by chain reactions of fission of uranium and transuranium isotopes, or as a result of the fusion of light nuclei from nuclear synthesis or thermonuclear reactions. A discussion is given of these means for producing atomic energy and their applications. Also discussed was the limitation of raw materials in the earth's crust, and the possibility of obtaining fuel and energy from the sun. A.L.B.

N64-23451 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MACHINE ENGINEERING (SELECTED ARTICLES)
28 Sep. 1962 41 p refs Transl. into ENGLISH of 2 Articles from Strojirenstvi (Prague), v. 12, no. 2, 1962 p 112–118, 119–128
(FTD-TT-62-940/1; AD-288526)

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1. POLYESTER PREMIXES B. Schreiber p 1–16 (See N64-23452 16-19)
2. THE TECHNOLOGY OF ADHESIVE BONDING OF METALS J. Peterka p 17–38 refs (See N64-23453 16-18)

N64-23460 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TRANSACTIONS OF THE CONFERENCE ON THE RESEARCH ON THE TWINKLING OF STARS (SELECTED ARTICLES)
7 Nov. 1962 32 p Transl. into ENGLISH from Soveshchaniya po Issled. Mertsaniya Zvezd., Moscow-Leningrad AN SSSR, 1959 p 33–46, 57–62
(FTD-TT-62-1343/1+2; AD-292230)

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1. TWINKLING OF LIGHT SOURCES ON THE EARTH A. S. Gurvich, V. I. Tatarskiy, and L. R. Tsvang p 1–13 refs (See N64-23461 16-12)
2. SOME NOTES ON THE REPORT BY L. A. CHERNOV AND M. N. KROM AND ON THE SPEECH BY E. A. BLYAKHMAN V. I. Tatarskiy p 14–19 (See N64-23462 16-06)

N64-23470 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEWS OF SCHOOLS OF HIGHER EDUCATION. AERONAUTICAL ENGINEERING Selected Articles
1 Mar. 1963 43 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (USSR), no. 2, 1962 p 65–71, 113–133, 138–151
(FTD-TT-62-1644/1+2+4; AD-400521)

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1. STABILITY OF A CIRCULAR CYLINDRICAL ENVELOPE IN A NON-UNIFORM TEMPERATURE FIELD V. V. Kabonov p 1–9 refs (See N64-23471 16-13)
2. A METHOD OF PROJECTING, AND THE RESULTS OF INVESTIGATING A VANELESS DEFLECTOR FOR RADIAL-AXIAL TURBINES A. V. Gubarev et al p 10–23 (See N64-23472 16-11)
3. CHARACTERISTIC THROTTLING FEATURES OF SINGLE-SHAFT BYPASS TURBOJET ENGINES IN DIFFERENT CONTROL PROGRAMS A. L. Klyachkin and A. G. Smirnov p 24–40 refs (See N64-23473 16-11)

N64-23487 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HEAT POWER ENGINEERING Selected Articles
14 Feb. 1963 43 p refs Transl. into ENGLISH from Teploenerg. (Moscow), no. 6, 1962 p 24–31, 88–91, 92–93
(FTD-TT-62-1738/1+2+4; AD-400514)

CONTENTS:
1. AN APPROXIMATE SOLUTION TO A TWO-DIMENSIONAL STATIONARY HEAT-CONDUCTION PROBLEM AND ITS USE IN THE DETERMINATION OF THE EFFECT OF ARTIFICIAL COOLING OF TURBINE COMPONENTS D. A. Pereverzev p 1–19 refs (See N64-23488 16–13)
2. OPTIMUM DIFFUSER SHAPE I. Ye. Virozub and A. Sh. Dorfman p 20–32 refs (See N64-23489 16–11)
3. MONOGRAMS FOR THE APPROXIMATE CALCULATION OF PROFILE FLOW IN TURBINE GRILLS G. Ya. Shnitser p 33–39 refs (See N64-23490 16–11)

N64-23491 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEWS OF SCHOOLS OF HIGHER EDUCATION AERONAUTICAL ENGINEERING (SELECTED ARTICLES)
27 mar. 1963 29 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zhvedenii, Aviats. Tekh. (USSR), no. 2 1962, p 56–64, 86–94
(FTD-TT-62-1769; AD-401596)

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1. CALCULATION OF NON-STATIONARY TEMPERATURE FIELDS OF A STRUCTURE WITH CONSIDERATION OF THE HEAT RADIATION DURING NON-STEADY FLIGHT PROGRAMS E. Tyan-tsi p 1–13 refs (See N64-23492 16–13)
2. EQUILIBRIUM EQUATIONS FOR STATIC BENDING AND FREE VIBRATION OF IRREGULARLY SHAPED CANTILEVER PLATES B. E. Sivehikov p 14–26 refs (See N64-23493 16–33)

N64-23494 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
POWER MACHINE CONSTRUCTION Selected Articles
4 Mar. 1963 83 p refs Transl. into ENGLISH from Energomashinostroyenie (Moscow), no. 221, 1962 p 5–16, 17–31, 32–46, 103–109
(FTD-TT-62-1816/1+2+4; AD-400535)

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1. STUDY OF THE OPERATION OF A CENTRIFUGAL COMPRESSOR WHEEL S. A. Anisimov p 1–19 refs (See N64-23495 16–17)
2. THE INFLUENCE OF THE NUMBER OF VANES ON THE EFFICIENCY OF THE CENTRIFUGAL WHEEL WITH A SINGLE-STAGE CASCADE S. A. Anisimov p 20–43 refs (See N64-23496 16–17)
3. STUDY OF THE EFFICIENCY OF CENTRIFUGAL COMPRESSOR WHEELS WITH A TWO-STAGE VANE CASCADE S. A. Anisimov et al p 44–68 refs (See N64-23497 16–17)
4. CALCULATION OF VARIABLE REGIMES OF CASCADE FLOW V. A. Zysin p 69–80 refs (See N64-23498 16–11)

N64-23532 Joint Publications Research Service, Washington, D.C.
NEWS OF HIGHER EDUCATIONAL INSTITUTIONS, MINISTRY OF HIGHER AND SECONDARY SPECIALIZED EDUCATION USSR, INSTRUMENT BUILDING SERIES, VOL. VI, NO. 5, 1963

31 Jan. 1964 168 p refs Transl. into ENGLISH of Izvest. Vyssh. Ucheb. Zaved. MVisso SSSR Po Razdelu Priborostroyeniye, v. VI, no. 5, 1963 p 3–147
(JPRS-23033; OTS-64-21462) OTS: $3.00

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1. UNIT FOR MEASURING INTEGRAL AND DIFFERENTIAL TWO-DIMENSIONAL FUNCTIONS OF DISTRIBUTION V. A. Pryanishnikov p 1–9 refs (See N64-23533 16-20)

2. REGULARITY OF CHARACTERISTICS OF SECONDARY EMISSION TUBES A. D. Golubev and S. Ya. Shatz p 10–19 refs (See N64-23534 16-09)

3. CERTAIN PRINCIPLES GOVERNING THE DESIGN OF MEMORY DEVICES WITH FERRITE CORES AND FULL-CURRENT RECORDING Ye. P. Balashov and V. L. Genkin p 20–27 refs (See N64-23535 16-20)

4. CONCERNING THE OPERATING STABILITY OF ELECTRIC CIRCUIT WITH ACTIVE UNITS CONTAINING TWO NONLINEAR RESISTANCES V. V. Sokolov p 28–35 (See N64-23536 16-09)

5. METHOD OF OPTIMUM ACCELERATION OF ELECTRIC DRIVE UNTIL ITS 3-STATOR MOTOR ROTATES WITH SYNCHRONOUS SPEED Ye. G. Barabanov p 36–43 refs (See N64-23537 16-09)

6. THE TORQUE OF TWO-PHASE ASYNCHRONOUS MOTOR CONTROLLED BY AMPLITUDE MODULATED VOLTAGE Ye. I. Baranchuk and Ye. L. Kovarskaya p 44–56 refs (See N64-23538 16-09)

7. REPRODUCTION OF TANGENTIAL FUNCTION WITH THE AID OF ROTARY SINE-COSINE TRANSFORMER A. A. Odintsov p 57–65 refs (See N64-23539 16-09)

8. PROBLEMS IN THE THEORY OF INERTIAL METHOD OF MEASURING ACCELERATION OF MOTION OF AIRCRAFT I. I. Pomykayev p 66–78 refs (See N64-23540 16-02)

9. INVESTIGATING THE EFFECT OF MANEUVERING AN OBJECT ON A GYROPENDULUM EQUIPPED WITH CORRECTORS M. M. Bogdanovich p 79–85 refs (See N64-23541 16-15)

10. CONCERNING THE MOTION OF FREE GYROSCOPE WITH UNIFORMLY ROTATING BASE N. V. Butenin and Ya. L. Lunts p 86–96 refs (See N64-23542 16-15)

11. INVESTIGATION OF ACCELERATION PICKUP HAVING FILTERING PROPERTIES K. N. Sergeyev p 97–108 refs (See N64-23543 16-09)

12. ABOUT ONE METHOD OF REGULATING THE MOVEMENT OF CLOCKS A. D. Romanov p 109–116 refs (See N64-23544 16-15)

13. CONCERNING THE IMAGE INCLINATION AND ROTATION IN OPTICAL INSTRUMENTS G. V. Pogarev p 117–126 refs (See N64-23545 16-15)

14. CORRECTING DISTORTION IN NEGATIVE SYSTEM HAVING EXTENDED PUPIL P. D. Ivanov p 127–142 ref (See N64-23546 16-06)

15. EXPERIMENTAL METHOD OF DETERMINING THE EQUIVALENT COEFFICIENT OF THERMAL CONDUCTIVITY OF TRANSFORMER WINDINGS p 143–153 refs (See N64-23547 16-09)

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17. TELEVISION UNIT WITH MEMORY TUBE FOR PRODUCTION OF CLICHE G. N. Gryazin p 157–159 ref (See N64-23549 16-15)

18. PROTECTING THE TRIGGERING ELEMENT OF A CODE B. Ya. Sovetov p 160–164 refs (See N64-23550 16-09)

N64-23551 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MECHANICS

S. S. Tikhmeneva, ed. 28 Aug. 1963 311 p refs Transl. into ENGLISH of the Book "Mekhanika" Moscow, Gos. Nauchno-Tekhn. Izd., 1961 p 3–181
(FTD-TT-63-254/1+2; AD-421826)

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2. SCIENTIFIC, PEDAGOGIC AND SOCIAL ACTIVITIES V. V. Dobronravov p 11–33

3. THE PRINCIPLES OF D'ALEMBERT-LAGRANGE AND HOLDER AND THE EQUATIONS OF MOTION OF MECHANICAL SYSTEMS WITH NON-HOLONOMIC COUPLINGS D. V. Dobronravov p 34–46 refs (See N64-23552 16-23)

4. CONTROLLED SYSTEMS AS SYSTEMS WITH NON-HOLONOMIC RELATIONSHIPS V. V. Dobronravov p 47–56 (See N64-23553 16-06)

5. ON THE RELATIONSHIPS BETWEEN COMPOUND QUANTITIES AND THEIR ELEMENTS V. V. Dobronravov p 57–64 refs (See N64-23554 16-23)

6. ON THE QUESTION OF THE BEHAVIOR OF CERTAIN GYROSCOPES S. S. Tikhmeneva p 65–71 (See N64-23555 16-23)

7. THREE THEOREMS ABOUT THE STRONG MINIMUM IN THE CLASSICAL PROBLEM OF THE CALCULUS OF VARIATIONS V. F. Krotov p 72–91 refs (See N64-23556 16-20)

8. ON THE OPTIMAL MODE OF HORIZONTAL FLIGHT OF AN AIRPLANE p 92–115 refs (See N64-23557 16-02)

9. ON THE FORCED VIBRATIONS OF A RECIPROCATING HYDRAULIC SERVO WITHOUT FEEDBACK Yu. Ye. Zakharov and V. N. Baranov p 116–133 refs (See N64-23558 16-11)

10. ON THE PROBLEM OF THE APPLICABILITY OF VOLTERRA'S DYNAMIC EQUATIONS TO NON-HOLONOMIC SYSTEMS G. N. Knyazev p 134–152 refs (See N64-23559 16-23)

11. INVESTIGATION OF THE STABILITY OF STEADY-STATE MOTION OF A SERVO WITH FEEDBACK WHICH IS BEING ACTED UPON BY A LOAD, TAKING INTO CONSIDERATION THE COMPRESSIBILITY OF THE OIL G. N. Knyazev p 153–165 refs (See N64-23560 16-23)

12. CLASSIFICATION OF THE MOTION OF A HEAVY RIGID BODY CONTAINING A STATIONARY POINT V. A. Chikin p 166–178 refs (See N64-23561 16-23)

13. GEOMETRICAL PROPERTIES OF ANTI-POLES FOR THE CASE OF A HEAVY, NON-SYMMETRICAL BODY MOVING AROUND A STATIONARY POINT IN THE GRIOLI CASE V. A. Chikin p 179–188 (N64-23562 16-23)

14. GENERAL EQUATIONS OF MOTION OF A RIGID BODY HAVING LIQUID-FILLED CAVITIES, AND THE GENERALIZATION OF ONE THEOREM I. S. Chikina p 189–221 ref (See N64-23563 16-23)

15. VIBRATIONS OF VISCOUS LIQUIDS CONTAINED IN A CYLINDRICALLY SHAPED CAVITY, WHICH IS IN STATE OF HORIZONTAL MOTION I. S. Chikina p 222–231 refs (See N64-23564 16-11)

16. DETERMINATION OF THE PERIOD OF VIBRATIONS OF A RESTRICTED RELEASING REGULATOR N. K. Lobacheva p 232–245 refs (See N64-23565 16-23)

17. ON THE INFLUENCE OF CLEARANCES IN BEARINGS AND OF THE ECCENTRICITY OF MASSES ON THE VIBRATIONS OF ROTORS M. F. Khromeyenkov p 246–278 refs (See N64-23566 16-17)

18. ON THE STABILITY OF AN AIRPLANE FOR THE

CASE OF MOTION OF ITS FUEL IN THE TANKS K. A. Golenko p 279-286 refs (See N64-23567 16-02)

19. ON ONE METHOD OF FINDING THE ACCELERATION OF A POINT IN THE CASE OF A PLANE-PARALLEL MOTION OF A BODY V. P. Kutler p 287-294 (See N64-23568 16-02)

N64-23589 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AUTOMATIC CONTROL OF AIRCRAFT ENGINES Selected Articles
7 Nov. 1963 142 p refs Transl. into ENGLISH from Atomat. Regulir. Aviadvigateley (Moscow), no. 3, 1961 p 1-32, 51-135
(FTD-TT-63-746/1+2+4; AD-426674)

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2. THE PROBLEM OF AUTOMATIC CONTROL OF A POWER PLANT A. A. Shebyakov and R. V. Yakovleva p 37-55 (See N64-23591 16-04)

3. ONE METHOD OF SELECTING REGULATOR SCHEMES AND PARAMETERS N. P. Kolpakova and S. I. Rybnikov p 56-64 refs (See N64-23592 16-04)

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6. THE TURBOJET ENGINE AND TURBOJET WITH AFTERBURNER AS A UNIT IN AUTOMATIC AIRCRAFT CONTROL SYSTEMS V. I. Novikov p 77-100 (See N64-23595 16-06)

7. EQUIVALENCE OF VARIOUS DIAGRAMS OF CLOSED ANTISURGE REGULATORS I. F. Yudin p 101-111 (See N64-23596 16-06)

8. SIGNAL CONVERSION DURING SIMULATION OF THE DYNAMIC PROPERTIES OF GAS-TURBINE ENGINES O. B. Vlasov-Vlasyuk p 112-138 ref (See N64-23597 16-04)

N64-23598 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RECORD OF APPLIED MECHANICS Selected Articles
30 Aug. 1963 58 p refs Transl. into ENGLISH from Arch. Mech. Stosowanej (Poland), v. 14, no. 3/4, 1962 p 461-487, 565-581
(FTD-TT-63-211/1+2; AD-421865)

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1. SUPERSONIC FLOW PAST BLUNT BODIES O. M. Belotsekovskiy and I. P. Chushkin p 1-31 refs (See N64-23599 16-02)

2. THE VELOCITY OF SOUND AND HUGONIOT'S ADIABATE FOR PARTIALLY IONIZED HEAVY INERT GASES A. Szaniawski p 32-54 (See N64-23600 16-11)

N64-23629 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CERTAIN PROBLEMS OF MECHANICS Selected Articles
28 Aug. 1963 70 p refs Transl. into ENGLISH from the Book "Nekotoryye Vopr. Mekhan." Moscow, Gos. Nauchnotekhn. Izd. Oborongiz, 1962 p 5-13, 14-25, 26-32, 107-126
(FTD-TT-63-571/1+2+4; AD-421424)

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3. DETERMINATION OF LOCAL DEFLECTIONS IN SHELLS OF AN LRE CHAMBER WITH VERY CLOSELY SPACED JOINTS Yu. M. Nikitin and V. B. Metlin p 32-39 refs (See N64-23632 16-23)

4. THERMODYNAMIC ANALYSIS AND HEAT CALCULATION OF A HIGH-VELOCITY CYLINDRICAL LRE COMBUSTION CHAMBER G. B. Sinyarev p 40-67 refs (See N64-23633 16-13)

N64-23634 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STATIONS IN SPACE (SELECTED ARTICLES)
10 Feb. 1964 70 p Transl. into ENGLISH from the Book "Stantsii v Kosmose" Moscow, Izd-vo AN SSSR, 1960 p 42-46, 49-54, 66-68, 214-229, 234-238, 259-264, 272-275, 284-288, 291-299, 376-380
(FTD-TT-63-1041/1+2; AD-435503)

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2. THE SECOND SATELLITE Yu. A. Pobedonostsev p 4-9 (See N64-23636 16-31)

3. THE FLYING SPACE LABORATORY L. I. Sedov p 10-11 (See N64-23637 16-31)

4. LIFE ON A SATELLITE P. Isakov p 12-22 (See N64-23638 16-31)

5. MAN BEFORE LAUNCHING INTO SPACE Ye. Yugov and A. Serov p 22-28 (See N64-23639 16-14)

6. FLIGHT TO MARS IS BECOMING A REALITY L. I. Sedov p 28-32 (See N64-23640 16-29)

7. ARTIFICIAL EARTH SATELLITES AND THE PROBLEMS OF SPACE FLIGHT N. P. Barabashov p 33-38 (See N64-23641 16-31)

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10. FIRST FLIGHT TO THE MOON p 47-56 (See N64-23644 16-29)

11. NONLIVING ASTRONAUT B. S. Danilin p 57-62 (See N64-23645 16-30)

N64-23676 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ENGINEERING JOURNAL Selected Articles
23 Mar. 1964 60 p refs Transl. into ENGLISH from Inzh. Zh. (USSR), v. 2, no. 3, 1962 p 14-42, 68-73, 119-125, 161-162.
(FTD-TT-63-79/1+2; AD-436796)

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2. LAMINAR BOUNDARY LAYER WITH REACTION FRONT ON A POROUS PLATE V. M. Yemel'yanov p 11–18 refs (See N64-23678 16-11)

3. DEVELOPMENT OF PLANE-PARALLEL BOUNDARY LAYER IN THE NEIGHBORHOOD OF THE CRITICAL POINT OF A BLUNT BODY, SET IN MOTION IMPULSIVELY Ye. M. Shakhov p 19–29 refs (See N64-23679 16-11)

4. ON THE NATURE OF FLOW IN THE STAGNATION REGION V. Ya. Neyland and G. I. Taganov p 30–38 refs (See N64-23680 16-11)

5. ON PLASMA ACCELERATION BY A MAGNETIC FIELD S. I. Fadeyev p 39–46 refs (See N64-23681 16-24)

6. ON THE BEHAVIOR OF HEATED PLATES AND SLOPING SHELLS IN A GAS FLOW V. V. Bolotin p 47–56 refs (See N64-23682 16-11)

7. THE EQUATION OF THREE VELOCITIES FOR A SHOCK TUBE A. I. Lashkov p 57–59 refs (See N64-23683 16-11)

N64-23701 Air Force Systems Command, Wright-Patterson AFB, Ohio

AEROSPACE EXPANDABLE STRUCTURES Conference Transactions

Mar. 1964 718 p refs Conf. Held at Dayton, Ohio, 23–25 Oct. 1963; in Cooperation with Natl. Cash Register Co. (AD-432006)

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2. AIRMAT STRUCTURES FOR SPACE AND LIMITED WAR APPLICATIONS J. T. Harris (Goodyear Aerospace Corp.) p 62–73 (See N64-23703 16-31)

3. FLEXIBLE FIBROUS MATERIALS AND COATINGS FOR EXPANDABLE RE-ENTRY SYSTEMS J. H. Ross (AFSC) p 74–94 refs (See N64-23704 16-38)

4. THEORETICAL AND EXPERIMENTAL INVESTIGATION OF METAL FABRIC EXPANDABLE STRUCTURES FOR AEROSPACE APPLICATIONS A. F. Foerster (Goodyear Aerospace Corp.) p 95–117 refs (See N64-23705 16-18)

5. LIMITED WAR APPLICATIONS FOR EXPANDABLE STRUCTURES A. Vasiloff (AFSC) p 118–136 refs (See N64-23706 16-01)

6. EXPANDABLE HANGARS FOR ORBITAL MAINTENANCE C. B. May, P. N. Van Schaik, and F. W. Forbes (AFSC) p 137–167 refs (See N64-23707 16-31)

7. EXPANDABLE SELF-RIGIDIZING HONEYCOMB FOR AEROSPACE STRUCTURES I. Russell, N. Hanssen, W. McKillip, B. Culbertson, and R. Slagel (Geophysics Corp. of Amer.) p 168–191 (See N64-23708 16-33)

8. GELATIN AS A RIGIDIZATION MATERIAL FOR AEROSPACE STRUCTURES F. W. Forbes, S. Allinikov, and C. Koons (AFSC) p 192–215 (See N64-23709 16-19)

9. MICRO-ENCAPSULATED POLYURETHANE FOAM REACTANTS FOR AERO-SPACE STRUCTURES R. Yoncoskie, R. Kass, and L. Lankston (National Cash Register Co.) p 216–235 (See N64-23710 16-19)

10. RIGIDIZATION OF EXPANDABLE STRUCTURES VIA GAS CATALYSIS T. Graham and R. Spain (AFSC) p 236–254 ref (See N64-23711 16-19)

11. EXPANDABLE LUNAR SHELTER CONCEPTS J. Alexander and K. Merkel (Cincinnati U.) p 255–284 (See N64-23712 16-31)

12. NASA INTEREST IN EXPANDABLE STRUCTURES N. Mayer (NASA, Wash.) p 285–318 refs (See N64-23713 16-33)

13. SELF-DEPLOYING SPACE STATION E. A. Weber (North American Aviation) p 319–339 (See N64-23714 16-31)

14. DEVELOPMENT OF AN INFLATED PARAGLIDER FOR MANNED ORBITAL ESCAPE J. Keville and F. Warren (Space General Corp.) p 340–354 (See N64-23715 16-32)

15. MSFC'S INTEREST IN EXPANDABLE STRUCTURES J. F. Blumrich (NASA, Marshall Space Flight Center) p 355–368 (See N64-23716 16-06)

16. ULTRA VIOLET AND HEAT RIGIDIZATION OF INFLATABLE SPACE STRUCTURES S. Schwartz, R. Jones, and L. Keller (Hughes Aircraft Co.) p 369–380 refs (See N64-23717 16-19)

17. THE POTENTIAL OF EXPANDED ALUMINUM MESH FOR INFLATABLE RIGIDIZED RADAR REFLECTIVE DEVICES L. V. Boler (Geophysics Corp. of America) p 381–396 (See N64-23718 16-09)

18. EXPANDABLE FOAM-IN-PLACE SHELTERS AND RELATED ITEMS J. F. Furrer (Army Natick Labs.) p 397–399 refs (See N64-23719 16-10)

19. AIR-SUPPORTED TENTS FOR MILITARY USE C. J. Monego (Army Natick Labs.) p 400–431 refs (See N64-23720 16-10)

20. MECHANICALLY MIXED POLYURETHANE FOAM-RIGIDIZED SOLAR COLLECTORS L. Manning (Goodyear Aerospace Corp.) p 432–460 refs (See N64-23721 16-19)

21. DEVELOPMENT OF A ONE PART "FOAM-IN-SPACE" POLYURETHANE S. Schwartz (Hughes Aircraft Co.) p 461–477 (See N64-23722 16-19)

22. MECHANICAL PROPERTIES OF COMPOSITE MATERIALS FOR EXPANDABLE SPACE STRUCTURES H. L. Price (NASA, Langley Research Center) p 478–500 refs (See N64-23723 16-19)

23. EXPANDABLE DRAG DEVICES FOR MACH 10 FLIGHT REGIME F. R. Nebiker (Goodyear Aerospace Corp.) p 501–510 (See N64-23724 16-30)

24. AN ELASTIC RECOVERY CONCEPT FOR EXPANDABLE SPACE STRUCTURES B. L. Daft (Narmco Industries, Inc.) p 511–534 (See N64-23725 16-30)

25. VARIABLE GEOMETRY SPACE STRUCTURES H. Sujata and C. Keng (Northrop Space Labs.) p 535–547 refs (See N64-23726 16-30)

26. TELESCOPING PRESSURIZED STRUCTURES AND SEALS W. Bandaruk and D. Younger (Aeronutronic) p 548–575 refs (See N64-23727 16-34)

27. DESIGN AND FABRICATION OF INFLATABLE AND RIGIDIZABLE PASSIVE COMMUNICATION SATELLITES R. J. Slater (G. T. Schjeldahl Co.) p 576–604 (See N64-23728 16-32)

28. INFLATABLE SPACE ANTENNA SYSTEM G. Reitmeier (Birdair Structures, Inc.) p 605–612 (See N64-23729 16-09)

29. ADVANCED RIGIDIZED MEMBRANE MATERIAL DEVELOPMENT F. Bratton, S. Stenlund, and A. Wendt (G. T. Schjeldahl Co.) p 613–652 refs (See N64-23730 16-32)

30. EXPANDABLE STRUCTURES RECOMMENDATIONS FOR THE FUTURE R. Liddell (Lockheed-California Co.) p 653–673 (See N64-23731 16-30)

31. ON THE STRUCTURAL BEHAVIOR OF INFLATED CYLINDERS UNDER VARIOUS LOADING CONDITIONS L. Kovalevsky and F. Rish (North American Aviation Co.) p 674–701 (See N64-23732 16-33)

32. STUDY OF THE MEMORY EFFECT OF POLYETHYLENE FOR SPACE EXPANDABLE STRUCTURE APPLICATIONS B. S. Bernstein (Radiation Applications, Inc.) p 702–714 refs (See N64-23733 16-19)

N64-23706 Air Force Systems Command, Wright-Patterson AFB, Ohio Aero Propulsion Lab.
LIMITED WAR APPLICATIONS FOR EXPANDABLE STRUCTURES
A. Vasiloff *In its* Aerospace Expandable Struct. Mar. 1964 p 118–136 refs (See N64-23701 16-01)

From an investigation of the limited-war applications for expandable structures, the following are concluded: (1) expandable-structure technology is feasible; (2) expandable structures offer definite advantages for limited-war usage; and (3) further expandable-structure research for limited-war applications is necessary. J.R.C.

N64-23868 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
XIII GENERAL ASSEMBLY OF THE IGGU. CHRONICLE
In its Cosmic Res. 27 Apr. 1964 p 260–287 (See N64-23852 16-29)

The basic results of the research into physics of atmosphere and meteorology that directly relate to the problem of cosmic research are examined. J.L.D.

N64-23946* National Aeronautics and Space Administration, Washington, D.C.
NINTH SEMIANNUAL REPORT TO CONGRESS, 1 JAN.–30 JUN. 1963
[1963] 231 p Prepared for Presentation to Congress
OTS: $15.50 ph

This report is divided into the following chapters: (1) manned space flight, (2) scientific investigations in space, (3) applications program, (4) advanced research and technology, (5) nuclear systems and space power generation, (6) tracking and data acquisition, (7) international programs, (8) informational and sponsored research programs, and (9) personnel, management, and procurement functions. In the appendixes are listed: (1) NASA-sponsored educational projects; (2) technical publications; (3) patentable inventions recognized by the agency's inventions and contributions board; (4) patent waivers granted and denied by NASA upon recommendation of the Agency's inventions and contributions board, both for the period January 1 through June 30, 1963, and for the total period of the Agency's existence; and (5) research grants and contracts, January 1 through June 30, 1963. P.V.E.

N64-23998* Indiana U. Foundation, Bloomington Aerospace Research Applications Center
[A PILOT PROGRAM FOR INVESTIGATING VARIOUS TECHNIQUES TO ENHANCE THE UTILIZATION OF NEW KNOWLEDGE RELATED TO OR STEMMING FROM AEROSPACE RESEARCH AND TECHNOLOGY] Quarterly Progress Report, Dec. 15, 1963–Mar. 15, 1964
Arthur M. Weimer [1964] 21 p
(Contract NASr-162)
(NASA-CR-56225) OTS: $2.60 ph

This report includes papers by industry on the role of ARAC in relation to information dissemination and the search services rendered. A proposal was made by industry for round-table discussions or lectures so that management could receive the latest in technical information. Exhibits are attached describing specific areas of progress of ARAC. E.C.

N64-24230 Avco Corp., Wilmington, Mass. Research and Advanced Development Div.
SELECTED REFERENCES ON THE ENVIRONMENT OF DEEP SPACE AND ITS EFFECT UPON THE SPACE VEHICLE, SUPPLEMENT NO. 1
P. Mulloney, comp. Sept. 1963 26 p refs

References on the following topics are presented: (1) space communication; (2) spacecraft guidance and control; (3) the physical and chemical aspects of Mars and Martian trajectories; (4) high-temperature materials for space flight; (5) spacecraft power systems; (6) space vehicles, per se; (7) spacecraft structures; and (8) the physical and chemical aspects of Venus. I.v.L.

02 AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW

Includes aerodynamics of channels, cowls, ducts, ejectors, nozzles, etc. *For related information see*: 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 11 Fluid Mechanics.

N64-22922 David Taylor Model Basin, Washington, D.C.
WIND TUNNEL INVESTIGATION OF FAVORABLE INTERFERENCE TO INCREASE LIFT-DRAG RATIOS OF SUPERSONIC AIRCRAFT. PART I—PRESSURE FIELDS AROUND A BODY AND AN INLET
Richard M. Hartley and Ernie W. Pope Apr. 1964 34 p refs
(DTMB-AERO-1063; AD-601232)

Wind-tunnel tests at a Mach number of 2.87 were made to measure the intensity and spatial distribution of low-pressure fields that radiate back from an indented side portion of a body and the high-pressure fields that radiate from the external wedge sides of an engine air inlet. The measured pressure distributions were integrated over a proposed thin flat-plate wing proposed for separating the body and inlet fields. The resulting favorable increase in normal-force coefficient was as much as 0.035 at zero angle-of-attack and corresponds to about 15% of the cruise lift required for an attack aircraft. Author

N64-22924 Naval Ordnance Test Station, China Lake, Calif.
CIRCUMFERENTIAL PRESSURE DISTRIBUTION ON AN INCLINED BODY OF REVOLUTION
K. Okauchi Apr. 1964 101 p refs
(NAVWEPS-8448; NOTS-TP-3406; AD-600138)

A summary is presented of the results obtained from wind-tunnel tests of a blunt-nosed body of revolution on which the circumferential pressure distributions at various stations along the body were determined. An empirical equation for calculating the circumferential pressure distributions on the cylindrical portion of the body is developed and compared with the experimental data. Author

N64-22963 Frost Engineering Development Corp., Denver, Colo.
VISCOUS MIXING OF TWO-DIMENSIONAL JETS WITH PARTICULAR REFERENCE TO JETS IN GROUND PROXIMITY
P. R. Payne Apr. 1964 111 p refs
(Contract DA-44-177-AMC-71(T))
(Frost Rept.-197-4; TRECOM-TR-64-11; AD-600499)

This report reviews the existing jet mixing theory and the best available experimental results. Simple mixing equations are developed and applied to the following problems. The average total pressure variation is determined as a function of

distance along a two-dimensional jet from the nozzle. The momentum flux change due to a static pressure change at some arbitrary distance from the nozzle is calculated. The theory of induced pressure forces due to free-air entrainment is developed, and potential flow solutions are given for the case of a static jet issuing from a plane wall, a jet issuing into a free stream from the trailing edge of an aerofoil (jet-flap propulsion) and a static jet issuing from a wedge. The generation of vortices in the cushion of a GEM is shown to be due to viscous mixing, and a method of calculating the lift loss due to this effect is shown to give reasonably good agreement with experiment. The effect of jet mixing on the central cushion pressure is also investigated, using both "thin jet" and "layered jet" approaches. The mixing equations are used to estimate the total head loss in a recirculating jet, and good agreement with experiment is obtained. This means that it is now possible to calculate the power requirements of a recirculating jet GEM and to optimize its geometry for minimum power loss. Author

N64-23033* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY ANALYSIS OF VARIATION OF PITCH MOTION OF A VEHICLE IN A SPACE ENVIRONMENT DUE TO FUEL SLOSHING IN A RECTANGULAR TANK
Donald G. Eide Washington, NASA, Jun. 1964 50 p refs
(NASA-TN-D-2336) OTS: $1.25

The equation of motion is derived for the angular rotation about the pitch axis of a space vehicle that is thrusting while partly filled with a liquid fuel that constitutes a large percentage of its mass. The forces due to thrust and rotation are of a magnitude equal to the capillary forces of the fluid and much greater than the Coriolis force. These forces are idealized to lie parallel to a longitudinal axis of the fluid tank. Changes in the angular rotation are generated by an impulsive torque applied to the vehicle. The fluid is considered to be irrotational, incompressible, inviscid, and contained in a rectangular tank. The resulting angular rotation of the vehicle and fluid system consists of the sum of a constant or average rotation and a cosine variation with time due to the motion of the fluid within the tank. The frequency of the variation is the slosh frequency of the free surface of the fluid. The slosh frequency is presented as a function of the inertial loading due to thrust, rotation, the amount of fluid in the tank, and the fluid-surface tension and density. The limit of thrust reversal for stability of the free-surface motion is established from the slosh frequency. The ability to minimize the sloshing effect by proper adjustment of the impulse magnitude and time of application is discussed, and an example is given. The response per unit impulse of a vehicle is presented for different loading conditions and fuel available for the change in angular velocity at the time of impulse, the average angular rate, the amplitude of the slosh variation, and the ratio of slosh variation to average angular rate. Author

N64-23150 France Office National d'Etudes et de Recherches Aeronautiques, Chatillon-Sous-Bagneux
THE STUDIES OF SUPERSONIC EXPLOSIONS [ETUDES DES DETONATIONS SUPERSONIQUES]
Pierre Liénard [1964] 7 p refs Presented at the 3ème Cong. Intern. pour la Lutte contre le Bruit, Paris, 13–15 May 1964 in FRENCH
(TP-118)

Sonic boom is briefly discussed theoretically and as to possible solutions. Experimental data are reviewed, and suggestions for further research are given. G.D.B.

N64-23328* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL CALCULATIONS OF HYPERSONIC AIR FLOWS OVER POINTED AND SPHERICALLY TIPPED BODIES AT SMALL ANGLES OF YAW
John V. Rakich N.Y., AIAA [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-430) AIAA: $0.50 members, $1.00 nonmembers

A method-of-characteristics computer program was used to study the first-order effects of yaw on the flow about bodies of revolution moving through air at speeds for which real-gas effects arising from dissociation and ionization need to be considered. First-order parameters describing the change with yaw of the surface pressure, density, enthalpy, and crossflow velocity are presented for several body shapes to illustrate differences between perfect-gas and equilibrium real-gas flows. The body shapes considered are pointed cones, a pointed ogive, and a spherically tipped cone. Ambient conditions correspond to those at 100,000 ft altitude. Flight velocities range from 5,000 to 75,000 fps for the pointed cones; ogive and sphere-cone results are presented for 20,000 fps flight velocity. Author

N64-23394* Avco Corp., Wilmington, Mass. Research and Advanced Development Div.
THEORETICAL PREDICTION OF THE EQUILIBRIUM REAL GAS INVISCID FLOW FIELDS ABOUT BLUNT BODIES, PHASE II Formal Written Report
Jun. 1963 27 p refs
(Contract NAS9-858)
(NASA-CR-52876) OTS: $2.60 ph

Two theoretical predictions of the equilibrium real-gas inviscid flow fields about blunt bodies are discussed: (1) the method of integral relations for real-gas flow over an axisymmetric body at large angles-of-attack—general equations and a method of solution for a sinusoidal distribution in θ (leeward plane of symmetry) and (2) flow field determination in the subsonic region at zero angle-of-attack—a short description of the mathematical basis of the approach of Garabedian and Lieberstein. P.V.E.

N64-23420 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF NEW M. E. I. NOZZLE CASCADES FOR SUPERSONIC VELOCITIES
M. Ye. Deych, A. V. Gubarev, L. Ya. Lazarev, and A. Dzhaganmakhan 4 Mar. 1963 15 p refs Transl. into ENGLISH from Teploenerg. (Moscow), no. 10, 1962 47–52
(FTD-TT-63-99/1+2+4; AD-400459)

Recommendations are made for the design of nozzle cascades that are distinguished by high efficiency over a wide range of supersonic velocities. Results of investigations of new cascades are given for Mach 0.6 to 1.8. Author

N64-23440 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
POLISH CIVIL AVIATION CONSTRUCTIONS
B. Piatkowski 18 Dec. 1963 16 p Transl. into ENGLISH from Wojskowy Przeglad Lotniczy (Warsaw), no. 10, 1963 p 52–62
(FTD-TT-63-1105/1+2; AD-429456)

A brief review is presented of recent aircraft construction and includes aircraft intended for use in communication needs, various fields of the national economy, and sports aviation. The following aircraft are described: PZL-101 "GAWRON," PZL-104 "WILGA," PZL-M4 "TARPAN," PZL-102B "KOS," MD-12, and MD-12F. P.V.E.

N64-23540 Joint Publications Research Service, Washington, D.C.
PROBLEMS IN THE THEORY OF INERTIAL METHOD OF MEASURING THE ACCELERATION OF MOTION OF AIRCRAFTS
I. I. Pomykayev *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 66–78 refs (See N64-23532 16–01) OTS: $3.00

This is a general analysis of the theory of the inertial method for measuring the value of aircraft acceleration as it is related to some system of coordinates and to the gradient value of the acceleration due to gravity. Author

N64-23557 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE OPTIMAL MODE OF HORIZONTAL FLIGHT OF AN AIRPLANE
V. F. Krotov *In its* Mech. 28 Aug. 1963 p 92–115 refs (See N64-23551 16–01)

This is a practical demonstration of the Kroton theory of the calculus of variables as applicable to the problems of airplanes caused by their propulsive force. A.W.

N64-23567 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE STABILITY OF AN AIRPLANE FOR THE CASE OF MOTION OF ITS FUEL IN THE TANKS
K. A. Golenko *In its* Mech. 28 Aug. 1963 p 279–286 refs (See N64-23551 16-01)

The equations of the disturbance system consisting of an airplane in almost horizontal flight and the motions of the fuel in its tanks are reduced to a system of ordinary differential equations. M.P.G.

N64-23568 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON ONE METHOD OF FINDING THE ACCELERATION OF A POINT IN THE CASE OF A PLANE-PARALLEL MOTION OF A BODY.
V. P. Kutler *In its* Mech. 28 Aug. 1963 p 287–294 (See N64-23551 16-01)

A geometrical method for finding the acceleration of a point on a moving plane figure is developed, based on the theorem that the tips of the reduced accelerations of two arbitrary points of the plane figure will lie on the perpendicular to the straight line connecting these points. M.P.G.

N64-23599 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SUPERSONIC FLOW PAST BLUNT BODIES
O. M. Belotserkovskiy and I. P. Chushkin *In its* Record of Appl. Mech. 30 Aug. 1963 p 1–31 (See N64-23598 16–01)

The cases of a supersonic flow of nonviscous perfect gas past a blunt symmetrical profile and past a solid of revolution of prescribed arbitrary shape set at a zero attack angle are examined. A numerical method, based on the use of high-speed computers, is outlined for solving the supersonic flow in the two given cases. P.V.E.

N64-23614* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
AN APPRAISAL OF STRUCTURES TECHNOLOGY—1964
Roger A. Anderson New York, AIAA, 1964 21 p Presented at the 1st AIAA Ann. Meeting, Washington, 29 Jan.–2 Jul. 1964
(AIAA Paper-64-531) AIAA: $0.50 members, $1.00 nonmembers

This report discusses progress and problems of aerospace structures, to provide perspective on the current technological stage. Structural progress is measured by the achievement of reliable lightweight designs in the face of new functional requirements and flight environments. Five broad categories—more effective construction materials, advance in fabrication techniques, operational experience, new theory and test data, and new flight-vehicle concepts—are covered in this study. G.D.B.

N64-23649 Oklahoma State U., Stillwater Ultrasonic Lab.
A STUDY OF ULTRASONICS FOR FLAW DETECTION IN TURBOJET ENGINES Final Report
James D. Simpson [1960] 208 p refs
(Contract AF 34(601)-14090)
(AD-436289)

The progress made in developing ultrasonic inspection methods for compressor blades of turbojet engines is documented, emphasizing the development of transducers for the inspection of J-79 and J-71 engine compressor blades. A usable surface-wave standardization system was developed. A unique type of calibration block was developed for accurate calibration of transducers and calibration of reject level and gain settings of the pulse-echo system. Protective paint coatings and ultrasonic cleaning are also discussed. G.D.B.

N64-23670* Astro Research Corp., Santa Barbara, Calif.
DEPLOYABLE CENTRIFUGALLY STABILIZED STRUCTURES FOR ATMOSPHERIC ENTRY FROM SPACE
H. U. Schuerch and R. Mac Neal Washington, NASA, Jul. 1964 38 p refs
(Contract NASw-652)
(NASA-CR-69) OTS: $1.00

A number of structural and aerodynamic concepts for centrifugally deployed variable geometry atmospheric entry aids are discussed. These include means for controlling apex angle of centrifugally stabilized conical flight bodies, the concept of isothermal flight, i. e., atmospheric entry at constant surface temperature, and analytical design of optimum rotor blade structures. Expressions for the aerodynamic forces on a rotor blade element are developed by using the Newtonian momentum concept and are applied to the problem of producing lift as well as drag during atmospheric entry. The relative merits of cyclic blade pitch, cyclic changes in effective blade area, and tip flapping vanes as trim control devices in lifting flight are discussed. Author

N64-23880 Lockheed Missiles and Space Co., Sunnyvale, Calif.
AERODYNAMIC CHARACTERISTICS OF BODIES OF REVOLUTION WITH FINS: AN ANNOTATED BIBLIOGRAPHY
George R. Evans, comp. Jul. 1963 123 p refs
(Contract NOw-63-0050-C)
(SB-63-76; Rept.-8-40-63-10; AD-423823)

The bodies of revolution may be of any configuration. The references are listed either by personal author or, when there is no personal author, by title. The subject index is divided into three sections and lists bodies of revolution of arbitrary configuration with any type of fin, (cylinders, cones, and blunt

bodies) and specific types of fins (canards, stabilizers, rudders, and wings); specific types of vehicles, such as Nike-Zeus, Skybolt, and Terrier. The specific aerodynamic characteristics are static stability, drag (axial force), pressure distribution, and force distribution. The Mach flow is from 0 to ∞. The period covered is January 1960 through June 1963. Author

N64-23908 Southampton U. (Gt. Brit.)
RESEARCH IN HYPERSONIC AEROTHERMODYNAMICS Final Report
K. N. C. Bray Feb. 1964 46 p refs
(Contract AF 61(052)-250)
(AASU-251; ARL-64-71; AD-436754)

Topics covered are as follows: (1) separated hypersonic flows produced by cavities in cone-cylinder models; (2) measurements in a low-density plasmajet wind tunnel; (3) running time and shock-wave attenuation studies in a shock tube; (4) an energy-balance equation to determine the electron temperature in a nonequilibrium plasma; and (5) a calculation of the rate of three-body electron–ion recombination using a simple classical model. A.W.

N64-23981 Utah U., Salt Lake City Upper Air Research Lab.
DIRECT IN SITU MEASUREMENTS OF WAKE CHARACTERISTICS OF RE-ENTRY VEHICLES Scientific Report No. 1
R. L. Stephenson, S. B. Hammond, K. L. Devries, and D. A. Burt 16 Mar. 1964 33 p refs
(Contract AF 19(628)-3243; ARPA Order 254-62)
(AFCRL-64-276; AD-441549)

A feasibility study was conducted on making in situ measurements in the wake of a reentry vehicle. Two methods of sensor positioning are considered: (1) ejecting a free capsule into the wake; and (2) ejecting and dragging a package that would remain physically connected to the reentry vehicle. Different types of sensors were studied for measuring various characteristics of the wake. It was concluded that a physically attached drag device could be constructed and flown. The drag device would position sensors for the measurement of electron densities. Author

N64-24025* Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
RE-ENTRY RADIATION AND AIR FLOW Eighth Quarterly Report, 1 Mar. – 31 May 1964
[1964] 6 p refs
(Contract NASr-119; Proj. Ag-1729-A)
(NASA-CR-56626) OTS: $1.10 ph

The determination of the nonequilibrium flow field and the optical radiation around a vehicle traveling at high speed and high altitude is investigated. The investigation centers around vibrational relaxation and vibration-dissociation coupling. J.R.C.

N64-24033* Aerojet-General Corp., Sacramento, Calif.
STUDY OF HIGH EFFECTIVE AREA RATIO NOZZLES FOR SPACECRAFT ENGINES Final Report, May 1964
V. H. Ransom et al Jun. 1964 275 p refs
(Contract NAS7-136)
(NASA-CR-56547; NAS-7-136-F) OTS: $17.50

This final report describes, in five chapters, certain nozzle concepts, including configuration and design; analysis of nozzle performance, including an account of losses, mission selection and mode of operation, payload capabilities for specific missions, and data obtained from missions; and current experimental programs in the field of nozzle development. A.W.

N64-24190 David Taylor Model Basin, Washington, D.C. Hydromechanics Lab.
THE PATH ANGLES AND ANGLES OF ATTACK AND DRIFT FOR LARGE MOTIONS OF A MOVING BODY IN A MOVING FLUID Research and Development Report
Frederick H. Imlay May 1964 39 p refs
(DTMB-1813; S-R009-01-01; AD-601469)

The linear-velocity kinematics of a body moving through a moving or stationary fluid are discussed. Three distinct velocities are considered—the absolute velocity of the body, the absolute velocity of the fluid, and the velocity of the body relative to the fluid. Exact expressions are derived for obtaining information about any one of the three velocities when certain data are known about the remaining two. Among the more utilitarian expressions offered are those for evaluating path angles and angles-of-attack and drift. Because exact solutions are given, there is no limitation on the severity of the maneuvers to which they may be applied. The application of the results to a few extreme maneuvers is illustrated by numerical examples. Author

N64-24202 Aerospace Research Labs., Wright-Patterson AFB, Ohio Hypersonic Research Lab.
CHARTS FOR USE WITH HYPERSONIC AIR WIND TUNNELS
William G. Reinecke Apr. 1964 25 p refs
(ARL-64-56; AD-601113)

This report contains a series of graphs for use with hypersonic air wind tunnels and is most conveniently used in conjunction with NACA Report 1135, "Equations, Tables, and Charts for Compressible Flows." The data presented differ from those in NACA 1135 in the following ways: data are computed for higher total temperatures; viscosity data due to Bromley and Wilke are used in the low static temperature regime; mean free path data are given; and the variation of γ with temperature is considered in all the computations. The graphs are plotted for any total pressure (within the range of validity of the analysis), for total temperatures through 5,000° R, and for Mach numbers through 30. The computed data are also used to determine an empirical relation between the Knudsen, Mach, and Reynolds numbers. Author

03 AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES

Includes ailerons; airfoil sections; cascades; fans; flaps; propellers; rotors; slats; spoilers; etc. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 11 Fluid Mechanics.

N64-23028* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONTROL-SURFACE INTERACTION EFFECTS ON DELTA-WING WINDWARD PRESSURES AT A MACH NUMBER OF 6.83 AT HIGH ANGLES OF ATTACK
Luther Neal, Jr. and David E. Fetterman Washington, NASA, Jun. 1964 47 p refs
(NASA-TN-D-2332) OTS: $1.25

An experimental investigation was conducted to determine the effects of nose incidence and trailing-edge-flap deflections on the windward pressure distribution over a 70° sweep delta wing at a Mach number of 6.83. The study was conducted

over an angle-of-attack range from 30° to 90° with nose incidence of 0° to 20° and flap deflections of 10° to −90° at a Reynolds number of 0.6×10^6, based on mean aerodynamic chord. Nose incidence produced large overexpansion effects on stations immediately behind the nose hinge line for the lower angles-of-attack, but did not significantly affect the pressure level over the rear portion of the wing. A similar overexpansion effect, produced by the middle panel, also occurred on negatively deflected flaps. These overexpansion effects were limited to angles-of-attack below about 70° and were not significantly affected by nose incidence. Large negative flap deflections caused a pressure reduction to occur ahead of the flap hinge line at the high angles-of-attack. Nose incidence had little effect on this flap-induced pressure reduction. A region of separated flow, which was essentially two dimensional with nose incidence of 0°, existed ahead of the flap hinge line for a flap deflection of 10° up to angles-of-attack of about 60°. Because of the unfavorable pressure gradient resulting from overexpansion effects on the middle panel, nose incidence increased the extent of the separated-flow region as well as introducing considerably more three dimensionality within the region of flow separation. Nose incidence also lowered the peak flap pressures, which with nose incidence of 0° significantly exceeded the stagnation pressure behind a normal shock near an angle-of-attack of 50°. Author

N64-23034* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A NUMERICAL METHOD FOR THE DESIGN OF CAMBER SURFACES OF SUPERSONIC WINGS WITH ARBITRARY PLANFORMS

Harry W. Carlson and Wilbur D. Middleton Washington, NASA, Jun. 1964 20 p refs

(NASA-TN-D-2341) OTS: $0.50

This report presents a numerical method based on linearized theory, which allows the determination of camber surfaces corresponding to certain specified load distributions for wings of arbitrary planform, and shows how these results may be combined with existing methods of selecting optimum combinations of loadings. To illustrate the application of the method and to point out certain features of wings with curved or cranked leading edges, a set of examples is presented. The principal checks on the precision of the method are made through comparisons with results for arrow- or delta-wing planforms by using established methods. Author

N64-23067 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE CALCULATION OF THE AERODYNAMIC CHARACTERISTICS OF THIN CURVED BODIES AND CURVED SURFACE WINGS

N. P. Korobeynikov *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 1–15 refs (See N64-23066 16-03)

The approximate theoretical analysis of the flow around thin deformed bodies is carried out by the use of the small perturbation theory. The effect of the body's cross section, the angle-of-attack, the load, and the lifting-force distribution are taken into account. An example is given for a curved wing, with varying positions of maximum curvature. The possibility of using the wing's twist as a means of longitudinal balance with positive trim margin is proved, and the favorableness of displacing the maximum curvature from the middle to the wing's trailing edge is demonstrated. D.E.R.

N64-23069 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

AN EXPERIMENTAL INVESTIGATION OF THE EFFECTIVENESS OF CERTAIN TYPES OF FLAT-STREAM DISCHARGE OF GAS ONTO A PROFILE WITH A FLAP

A. I. Matyazh (Kazan Inst. of Aviation) *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 26–41 refs (See N64-23066 16–03)

Presented are the results of an experimental investigation concerning the influence of an airstream on the aerodynamic characteristics of a profile with a slotted flap for different types of airstream discharge. Author

N64-23079 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MUTUAL ANNULAR WING-BODY INTERFERENCE WITH CONSIDERATION OF COMPRESSIBILITY OF FLUID

A. F. Moiseyenko (Moscow Aviation Inst.) *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 163–186 refs (See N64-23066 16-03)

A description is given of the steady motion of an annular wing and an infinite cylinder (body) in an ideal incompressible fluid and of their mutual interference. The calculation method obtained for low velocities is extended to high subsonic flow velocities considering fluid compressibility. The computation of the aerodynamic characteristics of an annular wing-cylinder combination in a compressible flow is reduced to a calculation of a fictitious combination in an incompressible flow. The problem is solved in linear formulation, making the basic assumption that the excitations due to the flow around the body being investigated are small in comparison with the flow velocity. The aerodynamic characteristics obtained by calculation are compared with experimental data. Author

N64-23356* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE DEVELOPMENT OF PARAWINGS FOR USE AS RECOVERY SYSTEMS

Charles E. Libbey N.Y., AIAA [1964] 8 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964

(AIAA Paper-64-472) AIAA: $0.50 members, $1.00 nonmembers

This paper presents a series of investigations to study some of the problems of deploying parawings for the recovery of boosters and nonlifting spacecraft. The investigations were conducted by means of radio-controlled drop tests of free-flying dynamic models. All of the deployment tests were conducted at low subsonic speeds. The prime considerations on the investigations were the mechanics and sequencing of events for deployment, and the dynamic stability and control characteristics of the configurations during deployment. Three different types of parawings and four different types of deployment techniques are discussed, and a summary of information obtained is presented. N.E.A.

N64-23625* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LOW-SUBSONIC AERODYNAMIC CHARACTERISTICS OF A DELTA-WING RECOVERY DEVICE FOR NONLIFTING SPACECRAFT

George M. Ware Washington, NASA, Jul. 1964 19 p refs

(NASA-TN-D-2349) OTS: $0.50

An investigation has been made to determine the low-subsonic aerodynamic characteristics of a small-scale 60° delta

wing with a spacecraft model attached directly to its lower surface. This configuration was intended to represent a spacecraft with an inflatable wing that would be deployed to give the spacecraft a glide landing capability following a ballistic reentry. The effect of the relative size of the spacecraft and wing was determined by the use of two different size spacecraft models with the same wing. The model was longitudinally stable about the assumed center-of-gravity position and had maximum trimmed lift-drag ratios of about 6 and 5 for the small and large spacecrafts, respectively. The configuration with the large spacecraft, which was the only one for which lateral tests were made, generally had low positive directional stability up to an angle-of-attack of about 29° and was unstable at the higher angles. Author

04 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc., and specific types of complete aircraft (e.g., Ground Effects Machines, Flexible Wings, STOL, and VTOL); flight tests; operating problems; safety devices; and stability and control. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 30 Space Vehicles.

N64-22896 Princeton U., N.J.
AN EXPLORATORY STUDY OF INSTRUMENT APPROACHES WITH STEEP GRADIENT AIRCRAFT
E. Seckel, J. J. Traybar, and G. E. Miller Ft. Eustis, Va., Army Transportation Res. Command, Oct. 1963 37 p refs
(Contract DA-44-177-TC-834)
(TRECOM-TR-63-28; Rept.-630)

A series of flight tests of an exploratory nature was conducted to determine the influence of certain parameters and quickened cross-pointer presentations on instrument approaches with steep gradient aircraft. Approximately 50 hooded instrument approaches were flown using a single-rotor helicopter piloted by a highly experienced NASA test pilot. Standard flight instruments were used, and the tracking presentation for the pilot consisted of an ILS-type cross-pointer indicator. Parallel beam patterns as well as the standard angular, wedge-shaped ILS beam patterns were simulated by a tracking theodolite system coupled to the aircraft cross-pointer by a radio link. Numerous beam widths, glide slope inclination angles, and quickening inputs were investigated. The maximum glide slope inclination angles studied were in the 8° to 11° range because of operational limitations of the aircraft and task (30 knots minimum airspeed and 500 fps maximum rate of descent). Parallel beam patterns (constant sensitivity) were preferred over the standard angular wedge-shaped beam patterns (sensitivity varying with range from transmitter). Author

N64-22907 Curtiss-Wright Corp., Caldwell, N.J.
AN INVESTIGATION OF THE OVER WATER ASPECTS OF VTOL AIRPLANES AT HIGH DISC LOADING Final Report
Raymond W. Dyke Dec. 1963 53 p refs
(Contract NOw-0279-D)
(Rept.-012-26; AD-601151)

Using small scale models of the X-100 and X-19 aircraft, tests were carried out to investigate the disturbance and spray caused by VTOL aircraft hovering above water. Full-scale disc loadings in the range 20 to 70 lb/sq ft were represented. Correlation of the model test results with full-scale testing of the X-100 airplane over water at a disc loading of 23 lb/sq ft and height of 21 ft shows excellent agreement. Downwash effects on objects floating below the X-19 model were also demonstrated. Spray is shown to rise to considerable heights at the higher disc loadings with the models close to the water surface, and floating objects may be subjected to severe buffeting under these conditions. Author

N64-22967 Aviation Safety Engineering and Research, Phoenix, Ariz.
U. S. AIR FORCE C-131E AIRCRAFT ACCIDENT. REPORT OF CRASH INJURY INVESTIGATION
Joseph L. Haley, Jr. and Gerrit J. Walhout Jan. 1964 60 p ref
(Contract DA-44-177-AMC-888(T))
(AvSER-63-8; TRECOM-TR-63-69; AD-440299)

This report covers the crash survival aspects of a C-131E (Convair 440) aircraft accident in which 19 of the 20 people on board the aircraft survived. No fire occurred in the accident. The wreckage was examined, photographs were obtained, and the approximate crash kinematics were determined. The failure of the passenger seat tiedowns was the most significant injury producer, although the one fatality was caused by the absence of any body restraint. Suggestions for strengthening the crew seats and passenger seats are made. Author

N64-23024* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL DETERMINATION OF THE TAKE-OFF PERFORMANCE OF SOME REPRESENTATIVE SUPERSONIC TRANSPORT CONFIGURATIONS
Robert L. Weirich Jun. 1964 25 p refs
(NASA-TN-D-2308) OTS: $0.75

The takeoff performance characteristics of typical supersonic transport configurations were analytically determined with aerodynamic characteristics representative of both delta-wing and variable-geometry configurations. The investigation considered conditions where the thrust was assumed constant and where the thrust decreased with increasing velocity. Optimum full-power takeoff distances and Civil Air Regulation runway lengths were obtained, and the results agree, generally, with previous similar studies. First-order empirical relations were determined, which correlate the data well. Design nomograms derived from these empirical relations are presented. The results indicate, in general, that the takeoff performance of the typical supersonic transports considered can be comparable to or better than present subsonic jet transports. Author

N64-23025* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FLIGHT VIBRATION DATA OF THE AEROBEE 150A SOUNDING ROCKET
James A. Nagy and Gomer L. Coble, Jr. Washington, NASA, Jun. 1964 30 p refs
(NASA-TN-D-2314) OTS: $0.75

Two channels of vibration data were obtained from each of two Aerobees launched from Wallops Island. During the powered phase of flight, vibration data for two vehicle axes were obtained from accelerometers mounted on the attitude control system (ACS). The highest vibration levels occurred while the rocket was rail guided. During this period the average levels were approximately 7 g's RMS longitudinally and 7 to 8 g's RMS laterally. After tower exit, vibration levels

dropped to low values and built up slightly at maximum q and at rocket motor burnout. Previous flights of three-fin Aerobees indicated vibration levels three times greater than those of the four-fin Aerobees, during the tower portion of flight. Author

N64-23099 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A PAIR OF AIRPLANES —A "HARD LITTLE NUT"
B. Ivanov 8 Jan. 1964 6 p Transl. into ENGLISH from Krasnaya Zvezda (Moscow), no. 167, 18 Jul 1962 1 p
(FTD-TT-63-1130/1; AD-429940)

The tactical actions of a pair of fighter planes in modern warfare are discussed in relation to their role as attacking and covering groups. J.L.D.

N64-23104 Robert E. Fulton, Co., Newtown, Conn.
FULTON AIR-TO-GROUND PICKUP SYSTEM FOR CARIBOU AIRCRAFT (OBSERVATIONS DURING JOINT ENGINEER-USER TEST)
Feb. 1964 49 p refs
(Contract DA-44-177-TC-804)
(TRECOM-TR-64-17; AD-600500)

Aerial recovery equipment was installed on an Army-type CV-2 Caribou aircraft. To evaluate the system, engineering and user tests were conducted; 64 pickups were performed of which 7 were successful personnel pickups. Emergency procedures as well as simulated operational pickups were tested with good results. Pilots experienced little difficulty during daylight in maneuvering the aircraft to intercept the lift line at the proper place; there were only three unintentional misses. Nine night operations were successfully conducted, and various combinations of lighting systems were used individually and collectively for evaluation by the pilots. With the proper combination and adequate pilot training, night pickups can be made as regularly as daylight ones. Author

N64-23171 Bollay (E.) Associates, Inc., Santa Barbara, Calif.
AVIATION FORECAST QUALITY CONTROL Final Report
B. Culbertson Feb. 1964 163 p ref
(Contract FA-WA-4403)
(RD-64-65)

This study was directed toward the development of a quality-control system, which the FAA might use to monitor the quality of the U.S. Weather Bureau's aviation forecasts—terminal (FT), winds aloft (FD), and area (FA). Recording procedures were devised and records maintained on forecast quality at sample locations throughout the study, and quality control techniques, procedures, and graphic result presentations were developed for each of the three forecast types. The report shows that FT and FD, because of their direct and limiting format, are amenable to quality control techniques and procedures, whereas FA is not, owing to the flexibility of organization and freedom of expression permitted therein. Author

N64-23232* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
TRENDS IN HIGH-SPEED ATMOSPHERIC FLIGHT
C. A. Syvertson and David H. Dennis N.Y., AIAA [1964] 11 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun. – 2 Jul. 1964
(AIAA Paper-64-514) AIAA: $0.50 members, $1.00 nonmembers

Some of the current problems and future trends for three types of flights within the earth's atmosphere are considered. The three areas examined are atmosphere entry at very high speeds, atmosphere exit of launch vehicles, and sustained cruise within the atmosphere. N.E.A.

N64-23237* North American Aviation, Inc., Columbus, Ohio
A SIMULATOR INVESTIGATION OF PILOT PERFORMANCE DURING EXTENDED PERIODS OF LOW-ALTITUDE, HIGH-SPEED FLIGHT
S. M. Soliday and B. Schohan Washington, NASA, Jun. 1964 102 p refs
(Contract NASw-451)
(NASA-CR-63) OTS: $2.50

Eight experienced jet test pilots performed piloting and navigational tasks during simulated low-altitude high-speed (LAHS) flight. The tests were made in a flight simulator that consisted of a vertically moving cockpit having a total travel of approximately 12 ft and an acceleration capability of ±6g. The simulator had a functional control system and an associated analog computer for obtaining solutions to the equations of motion of a mechanized aircraft. The experimental flights were made under varying conditions of gust, terrain, and airspeed. Performance and physiological measures were recorded continually during the flights. Blood samples, drawn after certain flights, were studied to determine biochemical effects of the flight stresses. Pitching errors made by the pilots varied with terrain and airspeed, and increased when the vertical accelerations increased in magnitude. Altitude errors increased steadily as the gust-induced normal accelerations increased. Performance of the navigational task did not vary with terrain, airspeed, or accelerations. Control stick displacement, frequency of control stick movement, heart rate, and respiratory rate varied systematically with several of the experimental conditions. Changes in certain enzymes were detected sufficient to warrant further study as indices of LAHS flight stress. A pencil-type side-stick controller was much more efficient than a conventional center-stick controller in the simulated flight. With the side-stick, task performance errors, total accelerations of the simulator, and heart and respiratory rates were reduced. However, fatigue effects were greater with the side-stick than with the center-stick controller. Pitch augmentation affected only pitch errors and control stick movements. Human transfer function coefficients varied with task complexity. Author

N64-23289 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AIR FORCE REVIEW (SELECTED ARTICLES)
27 Feb. 1963 21 p refs Transl. into ENGLISH from Wojskowy Przeglad Lotniczy (Warsaw), no. 2, 1962 p 43–57
(FTD-TT-62-1706/1+2; AD-400556)

Two articles are included: (1) Crewless Guided Reconnaissance Aircraft, and (2) Napalm Bombs. A brief description of the following aircraft is given in the first article: Radioplane RP-71, Aerojet SD-2, Republic Snooper SD-3, Republic Swallow, Fairchild Project M-252, Beechcraft Model 1013, Aviolanda AT-21, Meteor P.2, and Showa B-3 and B-4. The results of research (as reported by the western press) on napalm, an incendiary mixture, are presented in the second article. R.T.K.

N64-23334* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THEORETICAL vs ACTUAL NIKE-APACHE SOUNDING ROCKET PERFORMANCE

D. W. Dembrow and L. B. Jamieson Repr. from J. of Spacecraft and Rockets, v. 1, no. 2, 1964 p 221–222 refs
(NASA-RP-224)

The actual trajectory was determined by smoothing measurements from two separate radar plots. The theoretical trajectory was computed by using the given payload, weights, thrust, and drag conditions, and was based on equations of motion applying zero-lift, no-wind conditions for a spherical, nonrotating earth. Results show that the actual and theoretical trajectories disagree slightly. The peak altitude of the theoretical trajectory is higher than the actual by about 3 1/2 miles in about 100 miles. E.K.R.

N64-23350* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN AND OPERATING CONSIDERATIONS OF COMMERCIAL STOL TRANSPORTS
Curt A. Holzhauser, Wallace H. Deckert, Hervey C. Quigley, and Mark W. Kelly N.Y., AIAA [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-285) AIAA: $0.50 members, $1.00 nonmembers

This paper presents a study to show the relative merits of conventional and STOL aircraft when used in a commercial short-haul system. The study showed that there are many reasons for providing a short-haul commercial transport with STOL capability. The following are among the reasons: (1) a considerable increase in the number of the airports from which the aircraft can be operated; and (2) an increase in the safety and/or a reduction of the IFR minimums by virtue of the low landing-approach speeds obtainable with STOL aircraft. This study has also shown that a STOL aircraft capable of 60-knot approach speeds and 1,500-foot CAR field lengths can be operated at about the same cost as an airplane requiring a field length of 3,000 feet. N.E.A.

N64-23352* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF TREAD WEAR ON THE WET RUNWAY BRAKING EFFECTIVENESS OF AIRCRAFT TIRES.
Rafford J. W. Leland and Glenn R. Taylor N.Y., AIAA [1964] 8 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-346) AIAA: $0.50 members, $1.00 nonmembers

A series of wet runway braking tests was run at the landing-loads track in which smooth and dimple tires were used to represent completely worn tires. Five evenly spaced circumferential grooves were cut into the tires to depths representing varying degrees of tread wear. Two types of tire wear were simulated—uniform wear with all grooves cut to the same depth and nonuniform wear with the center groove wearing completely smooth while significant groove depths remain in the outer grooves. For both types of tread wear, a gradual degradation in braking effectiveness was experienced up to about the 80-percent worn tire condition, at which point the wet-runway friction coefficients dropped markedly. The completely worn tire was observed to develop, at the higher speeds, only about one-half the braking effectiveness of a new tire. Author

N64-23373* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF THE TRAJECTORY AND LARGE-AMPLITUDE MOTIONS OF A SCOUT VEHICLE DURING FOURTH-STAGE REENTRY FLIGHT
Uriel M. Lovelace, Sherwood Hoffman, and Robert J. Mayhue Washington, NASA, Jun. 1964 42 p
(NASA-TN-D-2309) OTS: $1.00

The fourth stage of a Scout vehicle experienced large-amplitude oscillations due to motor failure at an altitude of about 635,000 ft and a velocity of 17,800 fps. Radar lost the vehicle during the event. This investigation was undertaken to determine the accuracy of generating the trajectory, to analyze the motions, and to determine the type of motor failure during fourth-stage thrusting flight by using accelerometer and rate-gyro data as inputs in a digital computer program. The program was based on 6° of freedom and a spherical rotating earth. The generated trajectory variables for three sets of initial conditions agreed exceptionally well with those from radar. The computed forces, moments, and space motions gave a logical explanation of the type of motor failure. Errors in initial conditions, based on roll position, had a noticeable effect on the vehicle motions during the last 2.5 sec of flight when the angular rates were large and oscillatory. Author

N64-23378* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMICS AND FLYING QUALITIES OF JET V/STOL AIRPLANES
M. O. Mc Kinney, Jr., R. E. Kuhn, and J. P. Reeder The SAE-ASME Air Transport and Space Meeting, N.Y., 27–30 Apr. 1964
(ASME Paper-864A)

This report on the aerodynamics and flying qualities of jet V/STOL airplanes covers jet interference, effect of multiple jets, effect of wing planform, effect of jet deflection, inlet effects, exhaust velocity suppression, hot-gas ingestion, and control power requirements. J.R.C.

N64-23423 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE MAGNETIC FIELD, EXCITED BY THE PRIMARY WINDING, IN THE AIR GAP OF AN INDUCTION MACHINE WITH A CURVED STATOR
A. A. Lebedev 18 Mar. 1963 17 p refs Transl. into ENGLISH from Elektromekhanika (USSR), no. 5, 1959 p 14–23
(FTD-TT-63-157/1+2+4; AD-401742)

An evaluation of the magnetic field excited in an airgap by a stator that has a new type of winding is presented. The new winding is a curved-stator winding in which the load at the ends of the arcs of the stator is reduced to zero. The application of such a winding makes it possible to raise the efficiency of a motor having a curved stator and a massive rotor. The evaluation is made on the basis of the following assumptions: (1) The steel of the stator and rotor is not saturated and has a relative permeability of μ = constant. (2) The resistance of the steel of the stator and rotor in a radial direction is allowed for by a corresponding increase of the airgap. (3) The fundamental wave of magnetomotive force is considered. (4) The leakage currents are neglected. (5) There is no current in the rotor. (6) The resistances throughout the circuit are considered to be the same for the yokes of the stator and rotor. I.v.L.

N64-23500 France. Office National Detudes et de Recherches Aeronautiques, Chatillon-Sous-Bagneux
ON A METHOD OF ANTICIPATION OF JET NOISE DURING SUBSONIC FLIGHT [SUR UNE METHODE DE PREVISION DU BRUIT DES AVIONS A REACTION EN VOL SUBSONIQUE]

Michel Kobrynski 1964 19 p refs Presented at 3eme Congr. Intern. Pour La Lutte Contre Le Bruit, Paris, 13–15 May 1964 in FRENCH
(ONERA-TP-119)

It is maintained that the proposed method of calculating sonic boom can be applied to combatting jet noise. A take-off trajectory may be planned to greatly reduce resulting noise. G.D.B.

N64-23591 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE PROBLEM OF AUTOMATIC CONTROL OF A POWER PLANT
A. A. Shebyakov and R. V. Yakovleva *In its* Autom. Control of Aircraft Eng. 7 Nov. 1963 p 37–55 (See N64-23589 16-01)

The purpose of this article is to explain the features of a possible control system for a powerplant diagram somewhat modified compared with that given in Schultz's work. The diagram of a powerplant consisting of a reactor and a turbo-compressor unit that rotates the generator is examined. An automatic control system is also examined; a method is proposed for determining the optimum transfer function of the regulator by obtaining a given quality of the transients upon applying disturbances on the generator by a load and by changing the reactivity in the form of a single jump. G.D.B.

N64-23592 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ONE METHOD OF SELECTING REGULATOR SCHEMES AND PARAMETERS
N. P. Kolpakova and S. I. Rybnikov *In its* Autom. Control of Aircraft Eng. 7 Nov. 1963 p 56–64 refs (See N64-23589 16-01)

The problem of selecting a regulator system should be based on the calculation of the properties of the member, on the accuracy requirements for reproducing the control signals, and on the response of the system to disturbance effects. With given characteristics of the system in which the inverse transfer functions or frequency characteristics may be used, it is possible to determine an acceptable regulator design from this method. Established dependences between transfer functions of the system in stabilization and control conditions permit selecting a regulator that satisfies the given requirements of both conditions. G.D.B.

N64-23593 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINING THE LAW OF CONTROL OF ACCELERATION OF A TURBOJET ENGINE
N. P. Kolpakova *In its* Autom. Control of Aircraft Eng. 7 Nov. 1963 p 65–69 ref (See N64-23589 16-01)

The automatic control of a nonsteady engine with an astatic temperature regulator is examined. As the calculations show, the degree of instability is not large and has small deviations of small positive roots; the astatic regulator, therefore, should be considered acceptable. Such investigation is necessary in selecting a control program and in developing engineering requirements on the accuracy of a temperature regulator. G.D.B.

N64-23597 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SIGNAL CONVERSION DURING SIMULATION OF THE DYNAMIC PROPERTIES OF GAS-TURBINE ENGINES
O. B. Vlasov-Vlasyuk *In its* Autom. Control of Aircraft Eng. 7 Nov. 1963 p 112–138 refs (See N64-23589 16-01)

An attempt is made to estimate the errors arising during simulation of aircraft gas-turbine engines and to formulate the requirements for the converters used in these models. A method is examined for reducing the requirements imposed on the dynamic properties of the converters to facilitate their practical realization. The possible diagrams of certain types of converters are examined, and their characteristics are given. G.D.B.

N64-23623 Advisory Group for Aeronautical Research and Development, Paris (France)
THE INTEREST OF AERONAUTICAL ENGINEERS IN HYDROFOIL DEVELOPMENT
Patroclus J. Yangos Jul. 1963 53 p refs Presented at the 23rd Meeting of the Flight Mech. Panel, Athens, 8–10 Jul. 1963
(AGARD-473)

The development of hydrofoil craft is discussed in all aspects having equivalents in AGARD activities, namely, fluid dynamics, flight mechanics, avionics, structures and materials, and propulsion. The hydrofoil's aeronautical heritage is underlined, and its proper place in the transportation spectrum is explored. Contemporary hydrofoils and projects now in progress are discussed. Author

N64-23627 Radio Corp. of America, Los Angeles, Calif. Aviation Equipment Dept.
FEASIBILITY PROOF EQUIPMENT FOR DME-ILS Final Report
28 Feb. 1964 22 p refs
(Contract ARDS-585, Amend. 2, 3)

One DTB (NSME ground transponder) and two airborne DME's were modified to provide equipment suitable for in-flight evaluation. The modifications consist chiefly of reducing the pulse rise time, providing two-mode IF amplifiers to provide wider bandwidth for passing these pulses while maintaining high selectivity, changing the timing to the first pulse of the coded pair, providing a constant reply prf that is inpendent of the number of interrogating aircraft, and preserving the compatibility of the ground and airborne equipments to provide service with unmodified equipments within the VORTAC system. Author

N64-24014 Shell Development Co., Emeryville, Calif.
STUDY OF HELICOPTER GEAR LUBRICATION Quarterly Progress Report No. 3, Dec. 1963–Feb. 1964
S. J. Beaubien and L. Lichtman Feb. 1964 29 p
(Contract NOw-63-0557-c)
(S-131914; AD-435876)

Lubricants may be classified according to their effect on fatigue and their extreme pressure activity. Lubricants with high extreme pressure activity and low fatigue promotion are most desirable. Lubricants with fatigue promotion and high extreme pressure activity tend to produce pitting. Break-in can accelerate fatigue in a fatigue sensitive system, through contributions to the total number of stress cycles. An earlier conclusion that the cracks that proceed gear scoring may lead also to pitting was confirmed. It appears that such cracks arise from overstress of the metal in the contact zone, or from fatigue. The use of stub-tooth gears is desirable from the standpoint of strength of the teeth and scoring prevention, since those portions of the tooth that have the highest sliding velocity in a normal tooth are elimiated in the stub-tooth system. P.V.E.

N64-24031* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESPONSE OF SPHERICAL BALLOON TO WIND GUSTS
Kenneth D. Johnston 5 Mar. 1962 20 p refs
(NASA-TM-X-51710; M-AERO-A-12-62) OTS: $1.60

This report demonstrates the feasibility of measuring large wind gradients, or shears, by tracking a spherical balloon with radar as the balloon responds to these wind gusts. To determine how closely the balloon would follow the swiftly changing wind it was necessary to find the buoyancy, gravity, and aerodynamic drag of the balloon. An important criterion in the recording by radar of the wind profile is the difference between peaks for a given wind gust. Velocities, altitude, and peak differences are plotted, and formulas are given for a number of findings. A.W.

N64-24068 Naval Ordnance Test Station, China Lake, Calif. Aviation Ordnance Dept.
AN INVESTIGATION OF METHODS FOR DETERMINING THE VERTICAL VELOCITY OF AN AIRCRAFT
Ronald A. Erickson Mar. 1964 63 p refs
(NAVWEPS-8387; NOTS-TP-3293; AD-436815)

Various methods of computing the vertical velocity of an aircraft from information obtained from sensors in the aircraft were investigated for their accuracy. Large errors in vertical velocity computation result when the quantities are used individually, with the exception of Doppler vertical velocity during low vertical accelerations. Methods for obtaining acceptably accurate computation are studied. Author

N64-24077 Tactical Air Command, Langley AFB, Va.
OPERATIONAL TEST AND EVALUATION F-105F TRAINING SUITABILITY TEST
Mark D. Cook, Richard E. Merkling, and Arden A. Anderson Apr. 1964 49 p
(TAC-TR-63-20; AD-436594)

This test evaluated the F-105F aircraft in all phases of training, and in the operational role presently assigned to the F-105D. The F-105F weapon system is virtually identical to the F-105D weapon system. Being a two-place aircraft, the F-105F permits direct supervision, not previously possible, in the instrument and weapons system training environment. Less training will be required to increase pilot proficiency in weapon systems operation. Due to the limited visibility from the aft cockpit, the F-105F is not adaptable to all phases of the F-105 training program; however, its use in the other phases make it a valuable training vehicle. Author

N64-24088* Martin Co., Baltimore, Md.
PERFORMANCE MEASUREMENT IN FLIGHT SIMULATION STUDIES
R. W. Obermayer and F. A. Muckler Washington, NASA, Jul. 1964 22 p refs
(Contract NASw-718)
(NASA-CR-82) OTS: $0.75

An analysis of guidance and control performance measurements is made for five basic types of flight simulations studies: feasibility demonstrations; subsystem comparisons; studies of quantitative models of man–machine performance; handling qualities investigations; and, full-mission and total-system performance evaluations. Six studies illustrate the variety of possible measurement approaches that can be taken. General measurement criteria are derived from the evaluation considerations for any manned guidance and control system — stability response, reliability, adaptability, and acceptability. The selection of specific measures and some basic measurement problems are discussed. Author

N64-24114* Illinois U., Urbana
ON THE STEADY STATE AND TRANSIENT OPERATING CHARACTERISTICS OF LONG CYLINDRICAL SHROUD SUPERSONIC EJECTORS (WITH EMPHASIS ON THE VISCOUS INTERACTION BETWEEN THE PRIMARY AND SECONDARY STREAMS)
Alva Leroy Addy (Ph.D. Thesis) 1963 140 p refs
(Grant NsG-13-59)
(NASA-CR-56653) OTS: $10.50 ph

Theoretical and experimental investigations were made of the steady-state and transient operating characteristics of supersonic ejector systems. The present analysis introduces refined methods of dealing theoretically with the interaction of the primary and secondary flows in a wide variety of practical ejector configurations. Prominent in the analysis are the concepts of inviscid- and viscous-stream interactions that allow consideration of cases in which nonuniformities of the streams are of utmost importance. A theoretical calculation of ejector operating surfaces is presented that shows excellent agreement with experimental data over the entire range of the ejector operating surfaces. The theory is capable of dealing with noncylindrical and/or short ejector shroud configurations. A comparison of transient theoretical and experimental results is included. R.T.K.

N64-24165* Douglas Aircraft Co., Inc., Santa Monica, Calif.
AERODYNAMIC BRAKING TRAJECTORIES FOR PLANETARY ORBIT ATTAINMENT
Thomas W. Finch N.Y., AIAA [1964] 7 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D. C., 29 Jun.–2 Jul. 1964
(Sponsored by NASA)
(AIAA Paper-64-478) AIAA: $0.50 members, $1.00 nonmembers

The problems associated with aerodynamic braking into a Martian orbit are examined from the standpoint of vehicle and trajectory capability. Mars entry corridors for lifting vehicles are presented. Trajectories are developed that minimize the propulsive orbit injection velocity increment. The magnitude of the propulsive velocity increment is examined for these trajectories as a function of orbit altitude, vehicle lift-drag ratio and lift parameter, and entry velocity and peak load factor. Since the minimum propulsive velocity trajectories are found to be impractical, due to extreme sensitivity and lack of control capability, a class of trajectories is proposed that minimizes these difficulties. These alternate trajectories are found to require larger propulsive velocities for orbit injection. Propulsive velocity increments are again examined as functions of orbit altitude, vehicle lift/drag ratio and lift parameter, and entry velocity and peak load factor. Author

N64-24173 Air Force Flight Test Center, Edwards AFB, Calif.
AIR FORCE FLIGHT TEST CENTER RELIABILITY LITERATURE SURVEY
Clarence L. Roberts and Woodson M. Fountain 13 Apr. 1963 228 p refs
(FTC-TDR-63-13; AD-401902)

This work is a bibliography covering reliability literature. J.R.C.

05 ASTRONOMY AND ASTROPHYSICS

Includes celestial mechanics; and radioastronomy. *For related information see:* 12 Geophysics, and 29 Space Sciences.

N64-22749* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE SIMULTANEOUS COMPUTATION OF THE SECULAR AND RESONANCE EFFECTS IN THE MOTION OF CELESTIAL BODIES

Peter Musen Washington, NASA, Jun. 1964 18 p refs
(NASA-TN-D-2152) OTS: $0.50

The stability of the orbit of a celestial body depends predominantly upon the long-period perturbations in its elements. The long-period effects produced by the sun and the moon can prolong or shorten the lifetime of a satellite considerably. In every attempt to solve the problem of stability of the asteroidal ring, the long-period effects must be considered. Unfortunately, no convenient expansion of the disturbing function exists for large values of the eccentricity, large values of the inclinations, or large values of the ratio of the semimajor axes of the disturbed and disturbing body. Thus numerical integration must be used. In the problem of determining orbital stability, the disturbing function cannot be used in its standard form, because it contains the combined effects of the long- and short-period terms. If the short-period terms are not removed, then the integration step will be too short, and the accumulation of the errors from rounding off will be too great over a long time interval. Thus, before integration all short-period effects were removed from the disturbing function by a numerical process that avoids the development into series. The results of computation are not complete if they do not include the near resonance effects. As a result, Halphen's method is extended by inclusion of the near resonance effects caused by the commensurability of the mean motions of the disturbed and disturbing bodies. Liouville's method reduces the problem to a single harmonic analysis. The introduction of a nonsingular set of elements permits the extension of the method to the case of near-circular orbits and to the case of low inclinations of the orbital planes. Author

N64-22751* California U., San Diego

OPTICAL ACTIVITY IN SAPONIFIED ORGANIC MATTER ISOLATED FROM THE INTERIOR OF THE ORGUEIL METEORITE

Bartholomew Nagy, Mary T. J. Murphy, V. E. Modzeleski (Calif. U., La Jolla), George Rouser (City of Hope Med. Center), George Claus (NYU) et al Mar. 1964 27 p refs
(Grants NsG-341; NsG-541)
(NASA-CR-53660) OTS: $2.60 ph

An optically active fraction was obtained by saponification of solvent extracts from a stone of the Orgueil carbonaceous meteorite. The surface layer of this stone was removed with a high speed, dental-type drill prior to extraction to insure the exclusion of possible contaminations from the meteorite surfaces. The saponified meteorite extracts showed a small but well reproducible levorotation. Two saponified fractions obtained by the identical procedure from smaller fragments of two other stones of the Orgueil meteorite showed very similar levorotation. The chemical composition of the optically active fractions was analyzed by infrared, ultraviolet and visible spectroscopy, and thin-layer chromatography. The thin-layer chromatograms showed that the composition of the Orgueil meteorite extracts was wholly different from the composition of saponified fractions that can be isolated by identical procedures from recent biological matter (i.e., museum dust, ragweed pollen, marine algae, soil, naphthenic acids, etc.). P.V.E.

N64-22765* California U., Berkeley Space Sciences Lab.

SOME PHILOSOPHICAL ROOTS OF MODERN COSMOLOGICAL THEORIES AND THE CRITICAL TESTS BETWEEN THEM

Stephen Plagemann 11 Oct. 1963 20 p refs Submitted for Publication
(Grant NsG-101-61)
(NASA-CR-55177) OTS: $1.60 ph

The basic premises of the steady state and evolutionary theories in cosmology are discussed with reference to two diverging views about physical theories. Various theoretical arguments against the theories are examined and shown to be insufficient. The critical experimental tests between the cosmological theories are presented briefly. They are analyzed with the view that their successful completion depends upon future developments in the astronomical sciences. Author

N64-22766* California U., La Jolla

ULTRAVIOLET SPECTRA OF ORGANIZED ELEMENTS IN THE ORGUEIL METEORITE DETERMINED WITH THE ULTRAMICROSPECTROGRAPH

Bartholomew Nagy (Fordham U.), Kurt Fredriksson, Jan Kudynowski, and Leon Carlson (Karolinska Inst.) [1963] 6 p refs
(Grants NsG-317-63; NsG-341; NsG-98-60)
(NASA-CR-55366) OTS: $1.10 ph

An examination of the meteorite microstructures (organized elements) in petrographic thin sections and in powdered preparations of two stones of the Orgueil carbonaceous meteorite is discussed. The UV spectra of the acid-insoluble residues of individual organized elements showed absorption bands in the 2600 to 2800 A wavelength range. Chloroform extraction of the organized elements did not appear to change spectra. The organized elements investigated in thin sections were 8μ to 11μ in diameter, brownish-yellow in color, and were opaque in the UV range before acid leaching was employed to remove their mineral content. P.V.E.

N64-22779* New Mexico State U., University Park Research Center

PHOTOGRAPHIC OBSERVATIONS OF MARS AT NEW MEXICO STATE UNIVERSITY IN 1960–61

J. C. Robinson 9 Aug. 1963 19 p refs
(Grant NsG-142-61)
(NASA-CR-51173; TN-557-64-3) OTS: $1.60 ph

Photographic observations of Mars were made on a regular basis during the fall, winter, and spring, including the Martian vernal equinox. All the observations were made at the 20.12 Cassegrain focus of the University's 30-cm reflector. The photographic methods used are described. Among the phenomena observed and described are the following: Margaritifer Sinus, Cerberus I canal, Blue clouds and blue clearings, atmospheric belts, activity in the Tharsis-Amazonis region. Photographs and charts are included. E.K.R.

N64-23060 Observatorio De Cordoba (Argentina)

SOME LESSER KNOWN PROPERTIES OF RITCHEY-CHRETIEN TELESCOPES

Jorge Landi Dessy Repr. from Mem. Soc. Astr. Ital. (Rome), v. 34, fasc. 4, 1963 9 p refs In ENGLISH; ITALIAN Summary

The properties of Ritchey-Chretien telescopes were studied by taking the focal ratio of the primary mirror as a parameter. Ritchey-Chretien telescopes can be obtained with minimum plate curvature, greater total luminosity, and improvement of other optical errors if a greater obstruction is acceptable. Author

N64-23100 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

FORTY YEARS OF ASTRONOMY IN THE USSR, 1917–1957 (PART II) [BIBLIOGRAPHIYA RABOT PO ASTRONOMII VYPOLNENNYKH V SSSR ZA 1917–1957]

A. A. Mikaylov, M. S. Zverev, P. G. Kulikovskiy, A. G. Masevich, Ye. R. Mustel' et al 20 Jan. 1964 677 p refs Transl. into ENGLISH from the Book "Astronomiya v SSSR za Sorok Let 1917–1957" Moscow, State Publishing House, Phys. and Math. Div., 1960

(FTD-TT-63-1149/1+2+4; AD-429520)

This bibliography of Soviet astronomical literature, dating from 1917 to 1957, contains more than 9,500 titles of books and other literature by 1,800 authors, both Russian and other nationals, as published in the Soviet Union. G.D.B.

N64-23116* National Aeronautics and Space Administration, Washington, D.C.

REFINEMENT OF THE ASTRONOMICAL UNIT ON THE BASIS OF THE RESULTS OF RADAR OBSERVATIONS OF THE PLANET VENUS IN 1961 [UTOCHNENIYE ASTRONOMICHESKOY YEDINITSY PO REZUL'TATAM RADIOLOKATSII PLANETY VENERA V 1961 G.]

V. A. Kotel'nikov, B. A. Dubinskiy, M. D. Kislik, and D. M. Tsvetkov Oct. 1963 10 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), no. 17, 1963 p 101–106

(NASA-TT-F-8532)

The following data are basic for obtaining the astronomical unit—$\Delta\tau$, the difference in the actual and computed lag time; and Δf_d, the difference in the actual and computed Doppler frequency shift. Lag time refers to the time required for the signal to propagate from the antenna to the parts of the Venusian surface closest to Earth and back again. The Doppler shift used for refinement of the astronomical unit corresponded to the narrow-band component of the spectrum of the received signal, i.e., to the parts of the Venusian surface closest to Earth. Values of the time lag and Doppler shift were determined, and equations for the measured value of the astronomical unit are presented. An error analysis is also presented. The value of the astronomical unit was determined to be A = 149,599,300 ±2,000 km, which agrees well with values determined subsequently in countries other than the U.S.S.R. E.K.R.

N64-23128* National Aeronautics and Space Administration, Washington, D.C.

WATER DETECTION IN THE VENUS ATMOSPHERE [K VOPROSU OB OBNARUZHENII VODY V ATMOSFERE VENERY]

A. Ye. Salomonovich May 1964 15 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gor'kiy), v. 7, no. 1, 1964 p 51–58 Presented at the All-Union Conf. on Radio Astronomy, Gor'kiy, USSR, 28 Feb. 1963

(NASA-TT-F-8875)

The question of the nature of the cloud layer of Venus and the possibility of detecting water vapor in its atmosphere are discussed in the light of new data on the radio emission spectrum of the dark side of the planet. Author

N64-23784 Joint Publications Research Service, Washington, D.C.

MEASUREMENT OF RADIO EMISSION FROM THE MOON AT 50 cm WAVELENGTHS

V. D. Krotikov *In its* Izv. VUZov: Radiophys. 18 May 1964 p 1–5 refs (See N64-23783 16-28) OTS: $5.00

Precise measurements have been carried out of the integral radio emission of the moon at 50-cm wavelength by using an artificial moon. The disk average effective temperature equals 240° K ±14° K at the 50-cm wavelength. The results obtained confirm the conclusion made previously about the temperature increase in the moon's interior. Author

N64-23785 Joint Publications Research Service, Washington, D.C.

CONCERNING THE IONOSPHERIC MODEL OF VENUS

A. D. Kuz'min *In its* Izv. VUZov: Radiophys. 18 May 1964 p 6–18 refs (See N64-23783 16-28) OTS: $5.00

A model of Venus with a discontinuous, semitransparent, ionized layer has been examined. This layer is responsible for the increased radio emission of the planet in the centimeter and decimeter bands. The layer and the planet's surface parameters have been derived and show agreement of the calculated spectrum with the experimental one. The ionospheric model is also discussed in which the emission layer is located in the lower dense layers of the planet's atmosphere. The cosmic rays and the radioactivity of the atmosphere are possible sources of ionization. Author

N64-23786 Joint Publications Research Service, Washington, D.C.

MEASUREMENT OF THE ABSORPTION COEFFICIENT IN THE ATMOSPHERE AT DECIMETER WAVELENGTHS

V. K. Lastochkin and K. S. Stankevich *In its* Izv. VUZov: Radiophys. 18 May 1964 p 19–25 refs (See N64-23783 16-28) OTS: $5.00

The results and methods are described of measurements of radio-wave absorption in the atmosphere at the 25-, 32.5-, 44.3-, and 56.5-cm wavelengths by using radioastronomical methods. The zenith absorption at all the frequencies is 0.05 db. The comparison of the results with the absorption, calculated on the basis of Van Vleck's theory, shows that the theoretical magnitude of absorption is 1.8 times less than the experimental one for the bands mentioned. Author

N64-23804 Joint Publications Research Service, Washington, D.C.

CONCERNING THE METHOD OF PRECISION MEASUREMENTS WITH THE AID OF AN "ARTIFICIAL MOON"

N. M. Tseytlin *In its* Izv. VUZov: Radiophys. 18 May 1964 p 268–274 refs (See N64-23783 16-28) OTS: $5.00

In measurements using an artificial moon, where the standard signal is the difference between the antenna temperatures when the moon is placed in the principal lobe of the directivity pattern and then removed, it becomes necessary to observe the moon at large θ angles to reduce the influence of the earth's radio emission entering the antenna as a result of diffraction on the moon. Experimental dependence of the diffraction correction on the observation angle was presented for a moon with a diameter of $2a = 20\lambda$, and can readily be estimated with sufficient accuracy for different values of $2a/\lambda$ so that the measurement error can be reduced. In many cases it becomes possible to observe the moon at small elevation angles, which are technically easier to realize. G.D.B.

N64-23863 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

RADIO ASTRONOMY RESEARCH AND CURRENT CONCEPTS ABOUT THE ATMOSPHERE OF VENUS

A. D. Danilov *In its* Cosmic Res. 27 Apr. 1964 p 188–215 refs (See N64-23852 16-29)

Research on the physical characteristics of the surface and atmosphere of Venus has recently aroused much interest. Radio astronomy data have brought about concepts of the atmospheric conditions of the planet that differ sharply from those earlier proposed on the basis of optical data. There are currently two

hypotheses in serious contention for explaining data on the characteristic radio-wave emission of Venus, the greenhouse effect and the ionosphere. According to the greenhouse-effect hypothesis, in the atmosphere of Venus there must be a large quantity of water that so far was not successfully recorded. The difficulty with the ionosphere hypothesis is that it requires that a high electron concentration on the order of $10^9 cm^{-3}$ exist in the Venus ionosphere. The agreement between observed radio-wave emission spectra and radar data can be obtained if it is assumed that the Venus ionosphere has a porous character. Also, if the ionosphere is assumed to be porous, difficulties do not arise in explaining the absence of solar limb brightening that was found experimentally on waves of 1.6 and 3 cm. The correlation of the magnitude of the astronomical unit with solar activity shows the presence of a powerful ionosphere about Venus. Further research regarding the possibilities for both hypotheses is needed for a final decision to the question about the origin of radio-wave emission from Venus and the characteristics of its atmosphere. Author

N64-24057* Canterbury U., Christchurch (N. Zealand)
THE ANNUAL VARIATION IN THE RADIANT DISTRIBUTION OF SPORADIC METEORS
C. S. L. Keay Repr. from J. Atmospheric and Terrest. Phys., v. 25, 1963 p 507–513
(Grant NsG-219-62)

Meteor data obtained from the Southern Hemisphere confirm that the strengths of the helion, apex, and antihelion sources of sporadic meteor activity are in the ratio 2:1:2 when averaged over a whole year. During the year the helion and antihelion source strengths vary from 0.8 to 4.0 times that of the apex. Author

N64-24129 Observatorium Bosscha, Bandung (Indonesia)
THIRTY-SIX NEW PLANETARY NEBULAE
Pik-Sin The Bandung, Inst. of Tech., 1964 8 p refs *Its* Contrib. no. 26

In the present paper the result of a survey of H α-emission objects that show no continuum, tentatively classified as planetary nebulae, is reported. The survey region is about 80 square degrees and its center is at R.A. = 17 hr 20 min; Dec. = −28° (1950). A total number of 36 new planetary nebulae was discovered. The coordinates and identification charts of these nebulae are presented. Author

N64-24222 Harvard Coll. Observatory, Cambridge, Mass.
OH ABSORPTION SPECTRA IN THE SAGITTARIUS REGION OF THE GALAXY
S. J. Goldstein, Jr., E. J. Gundermann, A. A. Penzias (Bell Telephone Labs.), and A. E. Lilley 20 May 1964 10 p refs Submitted for Publication
(Supported by NSF)
(HRAP-114)

The 18-cm OH absorption spectrum of Sagittarius A was measured over a range of 6.4 mc/s using a 60-ft radio telescope. This frequency range covers both the 1,667 mc/s F(2→2) and the 1,665 mc/s F(1→1) transitions. The spectrum is dominated by two features at +40 km/sec and −120 km/sec with respect to the local standard of rest. An absorption spectrum for $l^{II} = 4°$, $b^{II} = 0°$. The characteristics of the background continuum radiation near 18 cm and this absorption spectrum allow an establishment of an upper limit on the state temperature of interstellar OH. I.v.L.

06 AUXILIARY SYSTEMS

Includes fuel cells and solar cells; gas turbines; hydraulic, pneumatic and electrical control systems and actuators; and inverters. *For primary propulsion systems see*: 27 Propulsion. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-22740 Joint Publications Research Service, Washington, D.C.
CONTROLLABLE PITCH PROPELLERS AND SHIP DESIGN
P. V. Orekhov and V. S. Murugov 18 Jun. 1964 79 p Transl. into ENGLISH from the Book "Grebnye Vinty Reguliruyemogo Shaga I Ikh Sovmestnaya Rabota S Silovymi Ustanovkami" Moscow, Acad. of Sci., 1963 p 3–47, 157–159, 180–185
(JPRS-25147; OTS-64-31515) OTS: $2.00

In this book controllable pitch propellers are discussed as follows: (1) classification; (2) advantages over fixed pitch propellers; (3) disadvantages; (4) development status and design features of those produced by Soviet plants and by foreign countries; (5) use with ship gas turbines; and (6) a plan for installing GTU-20 gas turbines and controllable pitch propellers in ships of the Leninskiy Komsomol type. I.v.L.

N64-22743 Joint Publications Research Service, Washington, D.C.
A CONTROL SYSTEM WITH DOUBLING ACTUATING ELEMENTS
I. T. Borisenok 23 Jun. 1964 22 p refs Transl. into ENGLISH from Vestn. Mosk. Univ. (Moscow), no. 2, 1964 p 83–96
(JPRS-25232; TT-64-31549) OTS: $0.75

Investigation of oscillations and conditions for their development in a control system with operating and defective doubling actuating elements are described. Cases of linear and nonlinear characteristics of actuating elements were examined. Doubling actuating elements are used in certain control systems to insure greater reliability. Undamped steady oscillations with sufficiently large amplitude are the subject of this investigation. G.D.B.

N64-22880 Naval Ordnance Lab., Corona, Calif.
SIXTH SYMPOSIUM ON AMMONIA BATTERIES
28 Jan. 1964 73 p refs Symp. Held at California U., Berkeley, 30–31 Jan. 1964
(NOLC-597; AD-433973)

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6. AUTOMATICALLY ACTIVATED AMMONIA BATTERY DEVELOPMENT D. J. Doan and L. R. Wood (Eagle-Picher Co.) p 34–39 refs (See N64-22886 16-06)

7. HIGH ENERGY DENSITY NON-AQUEOUS BATTERIES—GENERAL ENERGY CONSIDERATIONS ON THE ROLE OF THE SOLVENT W. F. Meyers (G. and W. H. Corson, Inc.) p 40–46 refs (See N64-22887 16-06)

8. SOME CHARACTERISTICS OF THE LITHIUM ELECTRODE AND LEWIS ACID-PROPYLENE CARBONATE ELECTROLYTES G. B. Adams (Lockheed Missiles and Space Co.) p 47–52 refs (See N64-22888 16-06)

9. APPROACHES TO THE ELUCIDATION OF ORGANIC ELECTRODE REACTIONS T. Kuwana (Calif. U.) p 63–69 refs (See N64-22889 16-06)

10. STATISTICAL METHODS IN ELECTROCHEMICAL RESEARCH H. H. Titus, J. Smit, and R. T. Foley (Melpar, Inc.) p 63–69 refs (See N64-22890 16-06)

11. NONAQUEOUS SOLVENTS DISCUSSION E. Griswold (Kansas U.) p 70

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N64-22882 Naval Ordnance Lab., Corona, Calif.

THE ELECTROREDUCTION OF NITROBENZENES IN LIQUID AMMONIA SOLUTIONS

William S. Harris *In its* Sixth Symp. on Ammonia Batteries 28 Jan. 1964 p 8–18 refs Previously Published as a Part of NAVWEPS-8141; (See N64-22880 16-06)

The reduction of nitrobenzenes was carried out by coulometric and polarographic methods. In the coulometric studies the very low rate reduction of various cathode oxidants in liquid ammonia solutions was carried out in a three compartment glass cell utilizing a stirred mercury cathode. The polarographic measurements were made in the same cell, but with the addition of a dropping electrode. From the coulometric and polarographic studies reduction schemes for nitrobenzenes in acid and neutral solutions have been proposed. N.E.A.

N64-22883 California U., Berkeley

EXPLORATORY OBSERVATIONS ON THE BEHAVIOR OF THE Ag/AgCl, Cl^- ELECTRODE IN LIQUID AMMONIA

Yuk Yuk Winston Cheh *In* Naval Ordnance Lab. Sixth Symp. on Ammonia Batteries 28 Jan. 1964 p 19–23 refs (See N64-22880 16-06)

Electrodes of the second kind, such as M/MX, X^-, are of potential interest for application as cathodes in combination with liquid-ammonia electrodes. Initial observations were made using the Ag/AgCl, Cl^- couple. To avoid complications resulting from the use of composite porous structures, thin deposits of AgCl were prepared during the charging process (formation of AgCl) and the discharging step. An H-type cell used in the investigation is described. Discussed are anodic and cathodic behavior and the apparent exchange current density. N.E.A.

N64-22884 Oregon State U., Corvallis

ALKALI METALS AS ANODES IN A LIQUID SULFUR DIOXIDE ELECTROLYTE

Michael J. Schaer and Robert E. Meredith *In* Naval Ordnance Lab. Sixth Symp. on Ammonia Batteries 28 Jan. 1964 p 24–29 refs (See N64-22880 16-06)

The advantages and disadvantages of using alkali metals as anodes in a liquid sulfur dioxide electrolyte are discussed, with major emphasis on electrolyte solution, electrode materials, and open circuit potentials. The feasibility of a single-cell liquid sulfur dioxide battery is also considered. N.E.A.

N64-22886 Eagle-Picher Co., Joplin, Mo.

AUTOMATICALLY ACTIVATED AMMONIA BATTERY DEVELOPMENT

D. J. Doan and L. R. Wood *In* Naval Ordnance Lab. Sixth Symp. on Ammonia Batteries 28 Jan. 1964 p 34–39 refs (See N64-22880 16-06)

(Sponsored by the Army)

This paper covers the current development status of liquid ammonia as an electrolyte solvent for application in batteries. Efforts were concentrated on an automatically activated system, and the basic principle used is that of the coil–gas generator–cell block system characteristic of highly reliable automatic silver–zinc batteries currently in use. The system characteristics are described, and the battery operation and failure modes are discussed. The test involved 27 factors in 64 trials. The factors were chosen to improve energy density, to elucidate the cathode gassing problems and, in general, to optimize cell design. They are listed in tabulated form. N.E.A.

N64-22887 Corson (G. and W. H.), Inc., Plymouth Meeting, Pa.

HIGH ENERGY DENSITY NON-AQUEOUS BATTERIES—GENERAL ENERGY CONSIDERATIONS ON THE ROLE OF THE SOLVENT

William E. Meyers *In* Naval Ordnance Lab. Sixth Symp. on Ammonia Batteries 28 Jan. 1964 p 40–46 ref (See N64-22880 16-06)

By selection of the basis and terms, a direct theoretical solution of the energy considerations on the role of solvents was obtained in terms of directly measurable quantities. The intended scope of the equations was limited to the specific task of selecting electrolytes that have reasonable probability of providing a given level of performance, assuming that the best currently available electrodes may be employed. The purpose of this limitation in scope was to prevent the need for frequent assumptions. N.E.A.

N64-22888 Lockheed Missiles and Space Co., Palo Alto, Calif. Materials Sciences Lab.

SOME CHARACTERISTICS OF THE LITHIUM ELECTRODE AND LEWIS ACID–PROPYLENE CARBONATE ELECTROLYTES

G. B. Adams *In* Naval Ordnance Lab. Sixth Symp. on Ammonia Batteries 28 Jan. 1964 p 47–52 refs (See N64-22880 16-06)

(Sponsored in Part by AF)

This paper presents a description of applied research studies on the characteristics of the lithium electrode, certain aspects of the lithium–silver chloride system, and recent results on Lewis acid–propylene carbonate nonaqueous electrolyte system. N.E.A.

N64-22889 California U., Riverside

APPROACHES TO THE ELUCIDATION OF ORGANIC ELECTRODE REACTIONS

Theodore Kuwana *In* Naval Ordnance Lab. Sixth Symp. on Ammonia Batteries 28 Jan. 1964 p 53–62 refs (See N64-22880 16-06)

Results are presented of an investigation of organic electrode reaction of quinones, organometallics, and linear and cyclic hydrazides. Also investigated are photoelectrochemical effects and the effect of electrode types and electrode surface conditions on organic electrode reaction. The following methods are used in the investigation: single-sweep and cyclic voltametry (linear potential scan), chronopotentiometry, and

coulometry coupled with in situ examination by absorption spectroscopy, electron spin resonance, photoabsorption, and emission. N.E.A.

N64-22890 Melpar, Inc., Falls Church, Va.
STATISTICAL METHODS IN ELECTROCHEMICAL RESEARCH
H. H. Titus, J. Smit, and R. T. Foley *In* Naval Ordnance Lab. Sixth Symp. on Ammonia Batteries 28 Jan. 1964 p 63–69 refs (See N64-22880 16-06)

This paper describes the application of statistical methods to battery research. These methods have a significant advantage over classical experimentation techniques, but utilizing these statistical methods in electrochemical research has disclosed certain limitations. These limitations are described. N.E.A.

N64-22906 Minneapolis-Honeywell Regulator Co., Hopkins, Minn. Ordnance Div.
LOW INPUT VOLTAGE CONVERSION
John T. Lingle and Sheldon D. Heaner [1963] 59 p
(Contract DA-36-039-SC-90808)
(QPR-5; AD-600843)

Major effort was expended in investigating voltage regulation and overload protection. Two types of pulse-width modulation regulation were investigated. One type was pulse-width modulation of the rectification circuit, controlled by a magnetic amplifier. The second type of regulator was an "add-on" series pulse-width modulator. Also, the converter circuit was modified in that a small choke coil, connected in series with a winding in the feedback transformer, is allowed to saturate, and the layout and parts procurement were started for the 50-w model. I.v.L.

N64-22962 Electrochimica Corp., Menlo Park, Calif. Research and Development Lab.
DIRECT AMMONIA-AIR FUEL CELL Quarterly Report No. 2, 1 Oct. 1963 – 1 Jan. 1964
Robert E. Kuppinger [1964] 63 p refs
(Contract DA-36-039-AMC-03245(E))
(AD-601268)

Studies during this period included experimental runs on direct ammonia fuel cells. Effects of temperature, composition, as well as run effect and block effect were investigated extensively through a statistical study program. The block effect was due to the employment of two separate sets of cells, reflecting possible differences in cell preparation. The data were subjected to a detailed analysis of variance testing all primary and interaction effects. Measurement of single electrode potentials was made by means of a new type of nickel–nickel oxide reference electrode. The development of this reference electrode is essential to all present and future kinetic studies on systems of this type. Experimental approaches related to problems in sealing cells and to electrode flooding are discussed. Data on performance of complete laboratory direct ammonia–oxygen fuel cells are presented and discussed. Author

N64-22957 Lockheed Missiles and Space Co., Sunnyvale, Calif.
ELECTROCHEMICAL BATTERIES: AN ANNOTATED BIBLIOGRAPHY
Peter S. Stromer, comp. Feb. 1963 156 p refs
(Contract AF 33(616)-7957)
(SB-63-14; Rept. 2-02-63-1; AD-441578)

An extensive review of the recent (1961–1962) literature on electrochemical batteries and their components has been made. Emphasis has been placed on power sources for guided missile and spacecraft applications. Latest developments in electrolytes indicate a trend from liquid to solid forms for high temperature use. Wherever weight considerations are paramount, nickel–cadmium, silver–cadmium, silver–zinc, and magnesium components have largely replaced the older lead–acid combinations. Author

N64-22968 Aerospace Research, Inc., Boston, Mass.
PORTABLE BATTERY CHARGERS Report No. 2, 1 Oct. – 31 Dec. 1963
Robert B. Craven and Charles A. Moo 28 Jan. 1964 132 p
(Contract DA-36-039-AMC-02330(E))
(ARI-191; AD-600044)

Basic battery-charging configurations that permit control of charging power by use of switch modulation methods are presented. Circuits using both transistor and silicon controlled rectifier switch modulators are described and compared. Pulse-width and pulse-frequency modulation methods are examined from the standpoint of suitability for control of charging power. It was concluded that the use of pulse-width switch modulation control of charger power results in a smaller required output-circuit smoothing-choke than is required using the pulse-frequency method. I.v.L.

N64-22969 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
THE CALIBRATION OF STANDARD SOLAR CELLS (MALTA, 1962 AND 1963)
F. C. Treble London, Min. of Aviation, Dec. 1963 25 p refs
(RAE-TN-SPACE-53)

Further work on the calibration of solar cells for use as test standards is described, and a summary is given of the results obtained during visits to Malta. Malta calibrations of British n-p silicon solar cells, irradiated to produce a wide range of spectral response, are compared with laboratory predictions of short-circuit current in sunlight above the atmosphere. Previous indications of the suitability of Malta as a solar-cell test site in the summer months are confirmed. A high standard of year-to-year consistency has been achieved in mean calibrations, using established techniques. Author

N64-23030* Minneapolis-Honeywell Regulator Co., Minn.
ROCKET BOOSTER CONTROL. TIME OPTIMAL CONTROL WITH AMPLITUDE AND RATE LIMITED CONTROLS
W. W. Schmaedeke and D. L. Russell Washington, NASA, Jun. 1964 40 p refs
(Contract NASw-563)
(NASA-CR-48) OTS: $1.00

Necessary conditions leading to a method for the determination of bounded control amplitude and amplitude rate time optimal control trajectories by backing out of the origin are developed. The backing out procedure requires choosing the response time, the unaugmented system adjoint vector at the response time, the rate-limited control variable amplitudes at the response time, and the rate-limited control variable amplitudes at the initial time. A set of consistency conditions on the control variables are then used to determine the allowable control variable trajectories from a finite set of possibilities. The state trajectories, including the state at the initial condition, can be determined in the usual manner from the control variable trajectories. Author

N64-23031* Tennessee U., Knoxville
NONLINEAR ADAPTIVE CONTROL SYSTEMS WITH STORAGE
Naresh K. Sinha Washington, NASA, Jun. 1964 22 p refs (Grant NsG-351)
(NASA-CR-64) OTS: $0.75

This paper considers adaptive control systems that have nonlinear controllers with storage. Staircase techniques were used to derive the optimizing equations for calculating the optimum parameters of the compensator for the least mean square error between the actual output and the desired output in terms of the statistical properties of the input signal and the plant dynamics. An example of an input-adaptive system was calculated that showed the superior performance of a power-series controller with storage over the optimum linear controller, as well as the optimum power-series controller without storage. Author

N64-23040* National Aeronautics and Space Administration, Washington, D.C.
EFFECT OF HIGH ENERGY PROTONS ON SILICON PHOTOCELLS [DEYSTVIYE PROTONOV VYSOKOY ENERGII NA KREMNIYEVYYE FOTOELEMENTY]
B. M. Golovin et al Feb. 1964 31 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, Sep.–Oct. 1963 p 271–286
(NASA-TT-F-8820)

The mechanism of formation of displaced atoms in a solid bombarded with electrons, neutrons, and protons having energies of up to 1,000 Mev is examined from a theoretical point of view. The effect on the operation of n-p silicon photocells of irradiation with protons with an energy of 650 Mev is studied experimentally. On the basis of certain simplifying assumptions, estimates were obtained of the relation between the output power of a silicon photocell and the time it spends in the central parts of the earth's inner and outer radiation belts. Author

N64-23159 Naval Air Test Center, Patuxent River, Md.
DYNAMIC MATHEMATICAL MODEL FOR EVALUATING AIRBORNE EXTERIOR LAMPS
David Ehrenpreis (Consulting Eng., Inc.) and John De Jong *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 161–169 refs Paper not Presented at Symp. (See N64-23151 16-01)

A mathematical model simulating the dynamic properties and characteristics of typical airborne exterior lamps is presented. The model includes as parameters single coil filament, double coil filament, filament supports, preload, partial fixity, distribution of masses, distribution of inertias, Young's modulus of tungsten at elevated temperature, and forcing functions. Natural frequencies, mode shapes, bending moments, shears, torsional shears, reactions, stresses, margins of safety, buckling, allowable strengths, deflections, and rotations are determined. The methods used to determine the dynamic properties and characteristics of these lamps may be used to determine natural frequencies and responses of other lamps and electrical equipment. P.V.E.

N64-23175 Ling-Temco-Vought, Inc., Dallas, Tex.
CONTROL MOTOR OPERATION BOUNDARIES AND RATE DIAGRAMS FOR THE ANALYSIS OF ON-OFF CONTROL SYSTEMS
M. N. Glazier, J. B. Hansard, and R. D. Herman 23 Jun. 1964 39 p ref
(Rept.-00.459)

Improved techniques are presented for analyzing on–off systems. The classic phase plane technique is improved by defining boundaries for the regions in which a control motor is on, thus providing a geometric means of accounting for all system constants, including lag times. The rate diagram is defined and its applications described. The rate diagram presents, in one concise plot, the behavior of an on–off system, including external disturbances and asymmetries, and defines rigorously the limit cycle condition. Author

N64-23198* Purdue U., Lafayette, Ind.
OPTIMUM NONLINEAR CONTROL FOR STEP AND PULSE DISTURBANCES
R. Oldenburger and R. C. C. Chang (Leeds and Northrop Co.) Repr., from ASME Paper 3, Session XVI [1962] p 441–450 refs
(Grant NsG-28-59)

This paper treats the responses of a controlled system to step and pulse disturbances where the rate of change of the controlling variable is bounded. Optimum transients in the sense of minimizing the maximum error, response duration, and other variables are derived for step and pulse disturbances whose parameters, i.e., magnitude, sense of change, instant of occurrence and pulse duration, are either completely known in advance, or known at the instant the disturbance starts, or not known in advance at all. It is shown that the more that is known about the disturbance beforehand, the better the response that can be obtained. Author

N64-23241 Raytheon Co., Burlington, Mass. Spencer Lab.
STUDY AND CORRECTION OF SPURIOUS POWER OUTPUT (RK6344 MAGNETRON) Quarterly Engineering Report No. 2, Oct. 22, 1963–Jan. 22, 1964
P. S. Bottorff [1964] 44 p refs
(Contract NObsr-89518)
(PT-687; QR-1248-Q2; AD-436199)

This report is concerned with the study and elimination of the causes of spurious power output from the RK6344A magnetron. Included in the study are an investigation into the nature and magnitude of spurious radiations emitted from the magnetron, attempts at reduction or elimination of spurious signals related to end space, tuner output resonances, and various spurious signals. G.D.B.

N64-23269* Purdue U., Lafayette, Ind.
INTRODUCTION TO TIME OPTIMAL CONTROL OF STATIONARY LINEAR SYSTEMS
R. Oldenburger and G. Thompson London, N.Y., Pergamon [1963] 30 p refs Repr. from Automatica, v. 1, 1963 p 177–205
(Grant NsG-28-59)

A problem that confronts the engineer desiring to use time optimal discontinuous control in a system is the determination of the loci of points in state space at which the steering functions should be switched to the opposite direction. The equations that define these loci are required for synthesis of the system controller. This paper is an exposition of an approach of R. Oldenburger and a solution of R. Bellman applied to seven examples to illustrate a method for finding these loci and to indicate the problems involved. The method works without complication for normal systems described by equations with real roots. By the La Salle approach, the method is extended to cover normal systems described by equations with complex roots. A final section shows how nonsymmetry of steering functions can be treated in practice. The steering functions for the nonsymmetric case are treated by replacing the nonsymmetric steering function by the sum of a symmetric steering function and a constant that describes the degree of asymmetry. Author

N64-23287 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE PROBLEM OF SYNTHESIZING BLOCK DIAGRAMS FOR SELF-ADJUSTING CONTROL SYSTEMS FOR TURBO-JET ENGINES WITH AFTERBURNERS

V. A. Bodner and Yu. A. Ryazanov 26 Feb. 1963 24 p refs Transl. into ENGLISH from the Book Avtomaticheskeye Regulirovaniye Aviadvigateley, Sbornik Statey, no. 3, Moscow, Oborongiz, 1961

(FTD-TT-62-1655/1+2+4; AD-401587)

The dynamic parameters of an ATE vary over wide ranges, in accordance with the flight and operational conditions; this study concluded that the optimal transient under all conditions may be obtained by varying the parameters of the correction circuits of the speed of revolution and gas temperature controls. Self-adjustment circuits are required for optimal value of the parameters; they are identical for control of the speed of revolution and the gas temperature. G.D.B.

N64-23299 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

APPROXIMATE INVESTIGATION OF SOME TYPES OF STRONGLY NONLINEAR AUTONOMOUS SYSTEMS

V. V. Kazakevich 15 Jul. 1963 93 p refs Transl. into ENGLISH from the Book "Avtomaticheskoye Upravleniye i Vychislitel'nogo Tekhnika" Moscow, Eos. Nauchno-Tekhnicheskoye Izd. Mashinostroitel'noy Lit., No. 5, 1962 p 365–442

(FTD-TT-63-319/1+2; AD-413127)

A detailed description of a method for approximate investigation of certain types of autonomous nonlinear systems is presented, and an attempt is made to derive the method from physical considerations. The reason for the unsatisfactory results obtained when the Van der Pol method is applied to some nonlinear systems is presented. A generalization of the proposed method to higher order systems is given. R.T.K.

N64-23303 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE COMBINED USE OF PULSE ATTRIBUTES IN PROTECTED CIRCULAR SIGNALS

Yu. Tomfel'd 19 Aug. 1963 26 p refs Transl. into ENGLISH from the book "Promyshlennaya Telemekhanika" Moscow, Izd. Akad. Nauk SSSR, 1960 p 115–129

(FTD-TT-63-528/1+2+4; AD-419226)

Results of investigations indicate the following: (1) It is necessary to have two *M* signals, each of which corresponds to one of the combinations of states of the objects of the group, in order to transmit information concerning the state of *M* two-position objects in one signal (i.e., for circular transmission in a group). (2) The combined use of pulse characteristics is more advantageous than the use of one pulse characteristic for circular transmission. (3) Circular transmission may be accomplished with the aid of systematic codes, by using a sampling method similar to a distributional method. (4) Protection from distortions, in the circular transmission method, can be realized both by the method of "protective refusal" and through error correction. (5) It is better, in the case of two-position objects, to use signals composed only of complete combination elements. It is better to use incomplete combination elements in the case of multiposition objects. I.v.L.

N64-23416 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PROBLEM NUMBER ONE—RELIABILITY

I. A. Berg 18 Mar. 1963 16 p Transl. into ENGLISH From Tekhnika Molodezhi (Moscow), No. 10, 1960 p 7–10

(FTD-TT-63-40/1; AD-402445)

This is a nontechnical article stressing the urgent need in the Soviet Union for greater reliability in all types of industrial and consumer machinery. Lacking is a clear standard of quality in the manufacture of most products. Quantity has been overstressed. Man–machine relationships are stressed as one of the keys to improving reliability. G.D.B.

N64-23462 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SOME NOTES ON THE REPORT BY L. A. CHERNOV AND M. N. KROM AND ON THE SPEECH BY E. A. BLYAKHMAN

V. I. Tatarskiy *In its* Transactions of the Conf. of the Res. on the Twinkling of Stars 7 Nov. 1962 p 14–19 (See N64-23480 16–16)

Soviet scientists comment on the work of colleagues engaged in stellar research. Among the topics discussed are the following: (1) influence of fluctuations in the amplitude and phase of a wave on the focusing properties of optical systems; (2) exclusive use of Gauss's function as the correlation function of fluctuations in the index of refraction; and (3) the need to consider defects in the optics of a telescope, as well as atmospheric perturbations, when viewing stellar images. E.K.R.

N64-23483 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

POWER ENGINEERING AND AUTOMATION

19 Feb. 1963 32 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Energ. i Avtom. (Moscow), no. 1, 1962 p 133–137, 152–157, 158–165

(FTD-TT-62-1720/1+2; AD-400534)

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N64-23484 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SYMMETRICAL ONE-FREQUENCY FORCED OSCILLATIONS IN NONLINEAR AUTOMATIC CONTROL SYSTEMS

V. V. Pavlov *In its* Power Engineering and Automation 19 Feb. 1963 p 1–8 refs (See N64-23483 16-06)

A method for using linear functions to study nonlinear automatic control systems is discussed. An ordinary approximation method for calculating accurate expressions for equivalent linearization of an essentially nonlinear member offers satisfactory results when investigating one-frequency forced oscillations in nonlinear automatic control systems. P.V.E.

N64-23485 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PRINCIPLE OF CONSTRUCTING SELF-ADJUSTING SYSTEMS

V. A. Gordeyev *In its* Power Engineering and Automation 19 Feb. 1963 p 9–17 refs (See N64-23483 16-06)

A self-adjusting circuit is discussed, which consists of a

basic circuit for determining the quality characteristics and operational elements. A number of possible quality indices and principles for use in constructing self-adjusting circuits for systems with rapid changes in the parameters of the basic circuit are discussed. P.V.E.

N64-23486 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ABOUT A TYPE OF SELF-ADJUSTING CONTROL SYSTEM
J. I. Chernetskiy and R. M. Yusupov *In its* Power Engineering and Automation 19 Feb. 1963 p 18–29 refs (See N64-23483 16-06)

Principles that can be used to create a self-adjusting system, applicable to the control of a wide class of objects, are presented. The basic advantage of such systems is that they take into account uncontrolled perturbations, which originate in both the object and the regulator. P.V.E.

N64-23529* General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science
RADIATION EFFECTS ON SILICON SOLAR CELLS Technical Summary Report, 16 May–15 Oct. 1963
V. A. J. van Lint, J. W. Harrity, D. K. Nichols, and D. P. Snowden 4 Dec. 1963 52 p refs
(Contract NAS7-91)
(NASA-CR-56563; GA-4797) OTS: $5.60 ph

Measurement of excess carrier recombination in semiconductor samples was taken; also, measurement was taken by electron-spin resonance; reanalysis was conducted of the data on rate of change of mobility with irradiation; theoretical investigations of the statistics of electron-hole recombination were made. G.D.B.

N64-23546 Joint Publications Research Service, Washington, D.C.
CORRECTING DISTORTION IN NEGATIVE SYSTEM HAVING EXTENDED PUPIL
P. D. Ivanov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 127–142 ref (See N64-23532 16-01) OTS: $3.00

Calculations are presented for designs of negative lenses that are necessary to make the distribution of light over the field of view more uniform for wide-angle multicomponent objectives. Results are displayed in diagrams, graphs, and tables, and conclusions relate to the choice of refractive index, angle, and number of negative lens components, the effects of multiple negative elements, and the corrections attainable with various configurations. D.E.W.

N64-23553 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONTROLLED SYSTEMS AS SYSTEMS WITH NON-HOLONOMIC RELATIONSHIPS
V. V. Dobronravon *In its* Mech. 28 Aug. 1963 p 47–56 (See N64-23551 16-01)

The paper examines controlled mechanical systems reducible to particles, and proposes solutions of their nonholonomic relationships, rheonomic relationships, etc., through the application of specific equations. A.W.

N64-23594 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EXPERIMENTAL DETERMINATION OF THE DYNAMIC PROPERTIES OF TURBOJET ENGINES AS UNITS IN AN AUTOMATIC FLIGHT-CONTROL SYSTEM
V. I. Novikov *In its* Autom. Control of Aircraft Eng. 7 Nov. 1963 p 70–76 refs (See N64-23589 16-01)

This article presents a differential equation for the thrust of a turbojet engine, obtained on the basis of experimental data. The dynamic parameters of an engine can be determined simply from amplitude-phase characteristics. G.D.B.

N64-23595 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE TURBOJET ENGINE AND TURBOJET WITH AFTERBURNER AS A UNIT IN AUTOMATIC AIRCRAFT CONTROL SYSTEMS
V. I. Novikov *In its* Autom. Control of Aircraft Eng. 7 Nov. 1963 p 77–100 (See N64-23589 16-01)

The purposes of this article were the following: (1) to determine the transfer function of turbojet engine thrust and the thrust of a turbojet engine with afterburner, according to control and disturbance effects from a thermogasdynamic calculation; and (2) to investigate the influences of the shape of the compressor characteristics, the engine operating conditions, the degree of afterburning, the flight, and the conditions of the dynamic parameters of the engine. G.D.B.

N64-23596 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EQUIVALENCE OF VARIOUS DIAGRAMS OF CLOSED ANTISURGE REGULATORS
I. F. Yudin *In its* Autom. Control of Aircraft Eng. 7 Nov. 1963 p 101–111 (See N64-23589 16-01)

This article is devoted to a theoretical investigation of the equivalence question of individual diagrams of antisurge regulators. Also treated is the problem of establishing the presence of equivalence of regulators having different regulating effects. G.D.B.

N64-23716* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC INTEREST IN EXPANDABLE STRUCTURES
J. F. Blumrich *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 355–368 (See N64-23701 16-01)

The purpose of making a payload structure expandable is to store it, at least during the atmospheric flight of a vehicle, in such a way that either its length is substantially reduced or its diameter is kept at a desired size. This means that primary interest is in its geometry and not in its weight. An expandable structure is by its very nature more complicated and less reliable than a rigid structure, so that it is used only when absolutely necessary. J.R.C.

N64-23942* Borden Chemical Co., Philadelphia, Pa. Central Research Lab.
RESEARCH AND DEVELOPMENT OF SEPARATORS FOR SILVER OXIDE-ZINC AND SILVER OXIDE-CADMIUM CELLS FOR SPACECRAFT APPLICATION Third Quarterly Report, Dec. 27, 1963–Mar. 27, 1964
H. E. Hoyt and H. L. Pfluger 6 May 1964 44 p refs
(Contract NAS5-3467)
(NASA-CR-56345) OTS: $4.60 ph

Although cycle life tests on experimental membranes are still in progress, several different types have exceeded the life of cellophane or give indication of doing so. Hydroxyethyl cellulose, polyvinyl alcohol and two of three variant hydroxyethyl polyvinyl alcohol types showed higher capacity than cellophane at the 50 amp discharge rate. Membranes used in the test cells and related compositions were first screened and characterized by tests for conductivity, flexibility, tensile strength, tensile

strength in 30% KOH, tensile strength after oxidation of 30% KOH saturated with Ag_2O, swelling in 30% KOH and 40% KOH. Data of the screening tests are presented. A number of candidates showed low electrical resistances of the order given by cellophane and stability to oxidation running from slightly better in the case of hydroxyethyl polyvinyl alcohols to much better in the case of some of the new candidates upon which life tests are at present unfinished. Author

N64-23978 Naval Research Lab., Washington, D.C. Protective Chemistry Branch
DIAPHRAGMS FOR THE SULFATE CYCLE ELECTROLYTIC CELL Final Report
S. A. Young, R. C. Clark, and K. D. Lawrence 17 Sep. 1963 15 p refs
(NRL-5995; AD-421167)

The study of diaphragms for the sulfate cycle electrolyzer included the screening of commercially available textiles, papers, and porous materials for their capability to be utilized as diaphragms; the development of techniques and equipment for the realistic evaluation of candidate diaphragms; the development of new combinations of fibers and resins to give improved service as diaphragms in the cell; and the determination of the service life of candidate diaphragms in miniature cells that reproduce the physical, chemical, and electrical atmospheres of the full-scale cell. Of the hundreds of materials included in this study, one form of commercially available microporous rubber was without question the material of choice for use as a diaphragm. From continuous electrolyzing runs in the miniature cells lasting 125 days, this material fulfilled the stringent requirements and provided the required solution flow rate, temperature, pressure, and normality of anolyte and catholyte. Author

N64-23980 Army Missile Command, Huntsville, Ala.
MATERIALS UTILIZABLE IN OPTICAL SYSTEMS WORKING IN THE INFRARED
P. Billard 19 Jun. 1964 94 p refs Transl. into ENGLISH from Acta Electron. p 7-66
(RSIC-193; AD-601845)

The materials that may serve in infrared optical systems are discussed. A classification is set up that is based solely on the refractivity and dispersion of the materials. The thermal and mechanical properties that may influence the performance of the optical systems are also discussed. Author

N64-23984 Harry Diamond Labs., Washington, D.C.
A SMALL, ULTRASTABLE, TRANSISTOR-REGULATED MULTIVOLTAGE POWER SUPPLY
Floyd Allen and H. J. Reed 1 Jun. 1964 18 p refs
(TR-1231; AD-601946)

A transistor-regulated multivoltage power supply has been designed to power a microwave transmitter. A battery voltage of 32 ±5 v is regulated, then transformed and rectified to yield outputs of 1,000, 160, and 2.5 v. The outputs are adjustable over the ranges ±4% to ±6.25% and +0% to −20%, respectively. The stability of the outputs for constant loads and input voltage variations of ±5 v is better than ±0.2%, ±0.625%, and ±1.0%, respectively. The power supply maintains this stability over a temperature range of −54° C to +75° C. Two of the output voltages are completely isolated from the input. Author

N64-23989* IIT Research Inst., Chicago, Ill.
INVESTIGATION RELATING TO THE DEVELOPMENT OF CADMIUM TELLURIDE ENERGY CONVERTERS Quarterly Report No. 1, 10 Jul.-10 Oct. 1962
R. J. Robinson et al 26 Oct. 1962 24 p refs
(Contract NASw-455)
(NASA-CR-56555; ARF-1220-QR-1) OTS: $2.60 ph

The objectives were to construct experimental cadmium telluride single-crystal solar cells and measure their electrical properties. The controlled atmosphere furnace for zone refining, zone leveling, and production of single-crystal cadmium telluride was modified to insure greater temperature uniformity and greater sensitivity to temperature changes. The major finding was that essentially single-crystal cadmium telluride could be prepared in a cast layer form, without seeding, under conditions in which a boule of cadmium telluride remains multicrystalline. A.W.

N64-24022* Martin Co., Baltimore, Md. RIAS Div.
ON A SYSTEM OF EQUATIONS IN AUTOMATIC CONTROL THEORY Technical Report No. 64-1
K. R. Meyer Jan. 1964 18 p refs
(Contracts NASw-718; AF 49(638)-1242; Nonr-3693)
(NASA-CR-56649) OTS: $1.60 ph

A control system in which the equations of the control take into account the applied load is discussed. The investigated system is

$$\text{eq. (1), } \dot{v} = Av - b\mu,$$

where v is the state vector and μ is the control. The control is governed by the equations

$$\dot{\mu} = \Psi(w)\Phi(\sigma)$$
$$\sigma = c'v - \rho\mu$$
$$w = 1 - \theta\mu \operatorname{sgn} \sigma.$$

In the equations, v, b, and c are n-vectors, μ, σ, w, ρ, and θ are scalars, and A is an n x n matrix. The functions Ψ and Φ are scalar continuous functions such that eq. (1) has a unique solution. Two cases are considered: (1) The nonsingular case where the matrix A has 2p simple imaginary characteristic roots and ℓ characteristic roots with negative real parts. (2) The singular case where the matrix A has a simple characteristic root zero and the other n−1 characteristic roots have negative real parts. P.V.E.

N64-24032* Eagle-Picher Co., Joplin, Mo. Couples Dept.
INVESTIGATIONS LEADING TO THE DEVELOPMENT OF A PRIMARY ZINC-SILVER OXIDE BATTERY OF IMPROVED PERFORMANCE CHARACTERISTICS Summary Report No. 1, 1 Jul.-31 Dec. 1963
B. R. Hawkins [1964] 50 p
(Contract NAS8-5493)
(NASA-CR-56363; CPB-13-0600-63) OTS: $4.60

Separator materials have been evaluated with respect to resistance to attack by potassium hydroxide, electrical resistance, speed of wetting, and electrolyte retention. Methods of separator testing and quantitative results are presented. A series of cells were designed for testing to establish an initial point of reference. The control or "standard" cell was not the optimum design for a long stand application. Under laboratory conditions, several separator combinations may allow high retention of charge at +70° F. Several variables have been organized in a "fractional factorial" experiment. Initial results are presented relative to this experiment design program, involving a standard temperature at +130° F. Author

N64-24045* Globe-Union, Inc., Milwaukee, Wis.
THE DEVELOPMENT OF HIGH ENERGY DENSITY PRIMARY BATTERIES, 200 WATT HOURS PER POUND OF TOTAL BATTERY WEIGHT MINIMUM Third Quarterly Report, 1 Feb.–30 Apr. 1964
Warren L. Towle [1964] 41 p
(Contract NAS3-2790)
(NASA-CR-56449) OTS: $4.60 ph

A primary battery is under development with an energy density of at least 200 w-hr/lb of total battery weight. Emphasis is placed on an aprotic electrolyte of high conductivity. Electrochemical tests are made to study behavior of the electrodes in the electrolytes possessing favorable electrolytic conductances. J.R.C.

N64-24080 University of Southern Calif., Los Angeles
ON THE THEORY OF OPTIMAL LINEAR CONTROL SYSTEMS
Jack R. Smith and Nasser E. Nahi Jan. 1964 62 p refs
(Contract AF 04(695)-304)
(USCEE-105; SSD-TDR-64-61; AD-436291)

This report is concerned with the derivation of optimal algorithms for systems that can be represented by ordinary differential equations. The control vectors considered are restricted such that either the norm of the control vector or the time integral of the square of the Euclidean norm of the control vector does not exceed a predetermined constant. The control vector minimizes the terminal difference between the desired state of operation and the actual state of operation. J.R.C.

N64-24086 Naval Research Lab., Washington, D.C. Electronics Div.
THE NRL VARIABLE DELAY GENERATOR
W. Beiles, W. K. Gayhart, and E. C. Bean Feb. 1964 13 p
(NRL-MR-1503; AD-435867)

This document reports on the operation of a general-purpose variable-delay generator for laboratory use. The generator was designed to provide a variable delay from 0.5μsec to 3900μsec with no measurable jitter. The pulse delay generator is completely transistorized, is housed in a lowered dust cover, and is portable. It is useful in the design of electronic circuits, maintenance of test equipment, and evaluation of commercially manufactured equipment. A.W.

N64-24091 Litton Systems, Inc., Woodland Hills, Calif.
EFFECTS OF NEUTRON AND GAMMA RAY SPECTRA ON FLIGHT CONTROL SYSTEMS Technical Documentary Report, Jan. 1963–Mar. 1964
Alvin B. Kaufman, Harry R. Newhoff, and Richard A. Gaz
Wright-Patterson AFB, Ohio, ASD, Feb. 1964 103 p refs
(Contract AF 33(657)-10584)
(FDL-TDR-64-30; AD-435603)

The program encompassed theoretical and experimental tasks in which neutron and gamma ray spectra, dose rate, and neutron–gamma ratios were studied to determine their relative importance in predicting radiation damage to flight control systems in nuclear environments of advanced aerospace vehicles. Six different nuclear facilities were utilized for the radiation tests. Three of the reactors were steady state and three were pulse type. Each reactor produced a distinct spectrum and dose rate signature, which was as fully defined as the state-of-the-art permits. The analytical and empirical program has developed equations and constants that, within certain limitations, may be used to predict the life of flight control components or systems in advanced nuclear system environments, such as encountered with SNAP, SLAM, etc. The performance of the components and systems tested and an analysis of the performance relative to reactor spectra and other environmental parameters are presented. Author

N64-24101* Inland Testing Labs., Dayton, Ohio Cook Technological Center
IMPROVEMENT OF NICKEL-CADMIUM BATTERIES Monthly Technical Progress Report No. 30, 20 Sep.–20 Oct. 1963
[1963] 26 p
(Contract NAS5-1048)
(NASA-CR-56556) OTS: $2.60 ph

A study is conducted to improve nickel cadmium batteries through testing and analysis of failures. Specifically, a number of batteries are subjected to operational and environmental tests to determine failure rates and modes of failure. J.R.C.

N64-24124* Philco Corp., Blue Bell, Pa. Scientific Lab.
THEORETICAL AND EXPERIMENTAL INVESTIGATION ON MODULATION INDUCING RETRODIRECTIVE OPTICAL SYSTEMS
12 Jun. 1964 20 p
(Contract NASw-721)
(NASA-CR-56566; MPR-12) OTS: $1.60 ph

Considerable effort was expended to ascertain the response of the cesium optical pumping system to audio-modulated microwave signals. Variations of signal were observed for a number of parameters, including audio-modulating frequency, power levels, and resonance bulb response time for a well stabilized microwave frequency; some data are included for response when the microwave frequency is swept through the resonance value at audio rates. In general, the results are similar to those previously reported for radiofrequency resonances. Saturation effects are clearly indicated in these experiments, showing much slower falloff than the predicted ω^{-1} response when the depumping microwave power level is high. Author

N64-24128 Northern Illinois U., DeKalb
SYNTHESIS OF INORGANIC BINARY COMPOUNDS USING EXPLODING WIRE TECHNIQUES
Micheal J. Joncich and Donald G. Rev [1960] 9 p refs

This is an exploratory study of the applications of exploding wire techniques to chemistry. Iodides, sulfides, and carbides of magnesium and aluminum were prepared in the experiments. Magnesium used was in the form of ribbon; aluminum used was in the form of foil. The summary of yields is given in tabular form. Another table gives for each compound prepared its formula, the equation for the reaction by which it was produced, and the equation for the analytical procedure determining the yield. A.W.

N64-24213 Harry Diamond Labs., Washington, D.C.
A MAGNETIC CORE ARMING PROGRAMMER FOR THE COPPERHEAD II FUZE SYSTEM
M. J. Katz and G. W. Kinzelman 20 Mar. 1964 28 p refs
(TR-1215; AD-600445)

An arming programer having a magnetic-core decade divider as the basic functional block has been designed for the Copperhead fuze system. The maximum time that can be programed is 100 sec with a maximum timing error of 0.1 sec. In addition to a firing pulse at T-0.0 sec, five output pulses at fixed times relative to T-0.0 are provided to initiate circuitry in the system. The timer has the capability of remote setting and, once set, does not require power for memory. Author

N64-24214 Lockheed-California Co., Burbank
METHODOLOGY FOR EVALUATING AND VALIDATING MECHANICAL RENDEZVOUS SUBSYSTEMS
Jack W. Lebold and R. N. Lahde Wright-Patterson AFB, Ohio, Res. and Technol. Div. Feb. 1964 281 p refs
(Contract AF 33(657)-10466)
(RTD-TDR-63-4292; AD-601322)

A methodology for evaluating and validating orbital attachment, and docking and latching mechanisms was determined. Primary emphasis was placed on validation facilities for systems capable of handling uncooperative, spinning, and nutating targets. Present state-of-the-art has been investigated, and additional docking concepts, providing specifically for the above type of target, were developed. Analytical and physical validation methods are developed and proposed. These include ground tests in which g forces are balanced or canceled by various computer and load-sensing devices with controlling servosystems, and by flight tests under zero-g conditions. Author

N64-24217 Goodyear Atomic Corp., Piketon, Ohio
STRESSES IN DIE CAST ALUMINUM AXIAL FLOW COMPRESSOR BLADES
C. O. Langebrake 4 May 1964 23 p
(Contract AT(33-2)-1)
(GAT-432) OTS: $0.50

Studies have been made on the stresses developed in die-cast aluminum blades in an axial-flow compressor operating in an environment of uranium hexafluoride. Tests were conducted both in a test loop and in a production area (cascade). Sixteen stator blades and one rotor blade in the test compressor were equipped with strain gages. The data showed that all stator blades had sufficient strength for normal operation, although considerably above-normal blade stresses occurred during startup and surging of the compressor under load. Severe blade stresses were encountered during shutdown of the compressor under load. These stresses were greatly reduced by decreasing the operating pressure (load). One row of stator blades appears to be stressed excessively during surging and during shutdown under load. No evidence of excessive blade stresses due to rotating stall was observed. One method of damping blades was tried but was unsuccessful. Author

07 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy); chemical engineering; chemical properties of materials; and synthesis. *For related information see*: 18 Materials, Metallic; 19 Materials, Nonmetallic; and 26 Propellants and Combustion.

N64-22738 Joint Publications Research Service, Washington, D.C.
CYCLOHEXANE-METALLIC CATALYST INTERACTION, CHEMICAL BOND ESTIMATION, AND ELECTROSTATIC ADSORPTION OF IONS
17 Jun. 1964 22 p refs Transl. into ENGLISH from Dok. Akad. Nauk SSSR (Moscow), v. 155, no. 3, 1964 p 626–628
(JPRS-25-115; OTS-64-31497) OTS: $0.75

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1. MECHANISM OF INTERACTION OF CYCLOHEXANE WITH THE SURFACE OF A METALLIC CATALYST A. A. Balandin, B. S. Gudkov, and R. M. Fedorovich p 1–5 refs

2. CHEMICAL BOND ESTIMATION FROM SUPERFINE STRUCTURE OF ELECTRONIC PARAMAGNETIC RESONANCE SPECTRA OF MANGANESE L. V. Bershov and A. S. Marfuin p 6–12 refs

3. PROPERTIES OF THE DOUBLE LAYER AND ELECTROSTATIC ADSORPTION OF IONS V. G. Levich, V. A. Kir'yanov, and V. S. Krylov p 13–19 refs

N64-22762* Massachusetts Inst. of Tech., Cambridge
THE DETECTION AND IDENTIFICATION OF ORGANIC MATTER BY MASS SPECTROMETRY Second and Third Semiannual Report, Jun. 1, 1962–May 31, 1963
K. Biemann [1963] 2 p
(Grant NsG-211-62)
(NASA-CR-50678) OTS: $1.10 ph

The investigation of the mass spectra of organic compounds of biological interest has been continued. Information has been obtained on the spectra of free amino acids, small peptides, carbohydrates, nucleosides, and purines and pyrimidines of the type occurring in nucleic acids. The spectra are being studied so as to identify compounds occurring in nature on earth. Also, methods are being developed to determine the structure of compounds not necessarily associated with terrestrial life. D.E.R.

N64-22794* Massachusetts Inst. of Tech., Cambridge
MASS SPECTRA OF ORGANIC MOLECULES. II: AMINO ACIDS
K. Biemann and James A. Mc Closkey [1962] 5 p refs
(Grant NsG-211-62)
(NASA-CR-56533) OTS: $1.10 ph

The mass spectra of amino acids, without prior conversion to more volatile derivatives, have been determined. Volatilization of the sample directly into the ion source and close to the ionizing electron beam gave excellent mass spectra of free amino acids and even their hydrochlorides. These spectra (determined with samples ranging from 0.25μg to 10μg) were quite similar to those of the corresponding ethyl esters, indicating that free amino acids, though present in the solid state as zwitterions, exist in the gas phase as the undissociated amino carboxylic acids or possible hydrogen-bonded forms thereof. The simplicity, speed, and sensitivity of the method described should make it a valuable tool for the identification and characterization of extremely small amounts of amino acids. I.v.L.

N64-22795* Aeronutronic, Newport Beach, Calif.
EXPERIMENTAL STUDIES FOR THE DETECTION OF PROTEIN IN TRACE AMOUNTS (J-BANDS) Third Quarterly Status Report, 1 Aug.–31 Oct. 1962
R. E. Kay [1962] 5 p
(Contract NASr-84)
(NASA-CR-56534; QLR-62-20) OTS: $1.10 ph

A dye method for detecting trace amounts of proteins, nucleic acids, and long chain polysaccharides in heterogeneous samples is presented. The method is based on the characteristic absorption spectra of the reactions of these macromolecules with an aqueous solution of the dye 3,3'diethyl-9-methyl 4,5,4',5' dibenzothiacarbocyanine bromide. The characteristic spectra (J-bands) were determined for proteins, dipeptides and tripeptides, synthetic polypeptides, DNA, RNA, and carbohydrates. In addition, the sensitivity of the dye reaction to temperature in the presence of nucleic acids, proteins, and inorganic salts can be used to distinguish these compounds by simply determining the optical density of the preparation at two temperatures. M.P.G.

N64-22796* Fordham U., New York, N.Y.
[INVESTIGATIONS OF METEORITE MICROSTRUCTURES AND OF ORGANIC MATTER IN CARBONACEOUS METEORITES] Semi-Annual Status Report
Bartholomew Nagy, Douglas J. Hennessy, and George Claus 12 Jul. 1963 4 p refs
(Grant NsG-341)
(NASA-CR-56535) OTS: $1.10 ph

Electron probe X-ray microanalysis of organized elements revealed an average presence of approximately 30% iron. Other organized elements contained silicate compounds. Preliminary work with the electron microscope revealed microstructures of distinct morphologies in the ultrathin sections of HCl-treated Orgueil samples. Examination with an ultramicrospectrograph of the ultraviolet absorption spectra of individual organized elements revealed absorption bands at 265-mμ and 280-mμ wavelengths. P.V.E.

N64-22881 California U., Berkeley
PHYSICAL PROPERTIES OF Ca-NH_3 SOLUTIONS
Wa-She Wong *In* Naval Ordnance Lab. Sixth Symp. on Ammonia Batteries 28 Jan. 1964 p 1-7 refs (See N64-22880 16-06)

In order to gain a better understanding of the physical properties of Ca-NH_3 solutions, the following measurements were performed at −40° C, −45.5° C, and −51° C: (1) viscosity of dilute Ca-NH_3 solutions and liquid NH_3; (2) conductivity of dilute Ca-NH_3 solutions; and (3) density of Ca-NH_3 solutions. All the experimental findings indicated that the physical properties of Ca-NH_3 solutions are quite different from those of alkali-metal ammonia solutions. This is probably due to the two valence electrons that are liberated when Ca dissolves in liquid NH_3. N.E.A.

N64-22885 California U., Berkeley
SOLVENT PROPERTIES OF DIMETHYL SULFOXIDE
William H. Smyrl *In* Naval Ordnance Lab. Sixth Symp. on Ammonia Batteries 28 Jan. 1964 p 30-33 refs (See N64-22880 16-06)

Dimethyl sulfoxide is a colorless, clear liquid in the temperature range 18.5° C to 189° C. It has a high Trouton constant (29.5), high dipole moment (3.9 Debye), and dielectric constant of 48.9 at 20° C. These properties indicate that the material should be a suitable medium in which to study the electrochemistry of inorganic materials. In addition to the solvent properties listed, some important physical properties of dimethyl sulfoxide are tabulated. N.E.A.

N64-22923 Radiological Defense Lab., San Francisco, Calif.
THE EFFECT OF SELECTED DILUENT GASES ON THE SELF-INDUCED ISOTOPIC EXCHANGE BETWEEN TRITIUM AND WATER VAPOR
C. H. Smith and L. H. Gevantman 13 Mar. 1964 14 p refs (USNRDL-TR-738; AD-601367)

The effect of various diluent gases on the rate of the self-induced exchange between tritium and water vapor was investigated. The gases studied were helium, neon, argon, krypton, xenon, air, nitrogen, oxygen, hydrogen, and ammonia. The average value found for a second-order rate constant, k_2 (1.28 ± 0.07) × 10^{-3} ml/mc/hr, for inert gases agreed with that found previously. Air and nitrogen as diluents yielded rate constants of 1.27×10^{-3} and 0.86×10^{-3} ml/mc/hr, respectively. Oxygen increased the rate over that observed in air, and hydrogen and ammonia were found to decrease it sharply. Author

N64-22964 Aerospace Corp., El Segundo, Calif. Computation and Data Processing Center
THE AEROSPACE CORPORATION COMPUTER PROGRAMS FOR THE SOLUTION OF MULTIELEMENT CHEMICAL EQUILIBRIA. VOLUME II: CHEMICAL PROGRAM DESCRIPTION
H. J. Vale 17 Jul. 1963 224 p refs
(Contracts AF 04(695)-69; AF 04(695)-169)
(DCAS-TDR-62-138, Vol. II; TDR-69(2240-51)TR-2, Vol. II; AD-414650)

Work has been completed on a system of programs to compute complex chemical equilibria. These programs use a general numerical and analytical approach and accept a very flexible problem formulation. The computation capabilities of this system include rocket engine performance, flame composition and temperature determination, Mollier diagram production, and equilibria solution for any prescribed regime of pressure and temperature. Ionic species are considered if requested and available. Author

N64-22970 Grumman Aircraft Engineering Corp., Bethpage, N.Y. Advanced Development Program
DETERMINATION OF ORGANIC RESIDUE FROM SOLVENTS BY RADIOISOTOPIC METHOD
John G. Masek 28 Oct. 1963 30 p refs
(ADR-08-13-63.1)

A radioisotopic method was developed for evaluating organic residue and contamination left by proprietary solvents. Freon T.F., evaluated with this technique, left an organic residue on aluminum that outgasses when exposed to a vacuum. Author

N64-22999 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE CATALYTIC PROPERTIES OF CHELATE POLYMERS
G. K. Boreskov et al *In its* Rept. of the Acad. of Sci. of the USSR 5 Mar. 1963 p 8-16 refs (See N64-22997 16-24)

Eight chelating agents, in four categories according to chelating atoms, were complexed with copper, nickel, cobalt, zinc, cadmium, palladium, and iron. These complexes were polymers or were treated to become polymers, and were then tested for their catalytic activity in decomposing hydrazine. Polychelates of the transition metals were the only ones with catalytic effect, in the following order of decreasing activity: copper, palladium, nickel, cobalt, and iron. The chelating agent enhances the catalytic effect in some cases, especially those chelates in which the metal atom is bound to a nitrogen and to a sulfur atom. Catalytic activity and selectivity of the polychelates were determined by the metal in the polychelate, by the nature of the linking atoms in the chelate function, and by the organic part of the polymer. D.E.W.

N64-23005 Joint Publications Research Service, Washington, D.C.
PHOSPHORYLATION OF ALLYL ALDEHYDE POLYMER
Yang Shih-Hsien, Ho Ping-Lin, and Yu Yao-T'ing *In its* Transl. on Communist China's Sci. and Technol., no. 86 25 May 1964 p 14-17 refs (See N64-23001 16-01) OTS: $0.75

A method is given for the phosphorylation of an allyl aldehyde polymer, based on the reaction of the polymer with phosphorous trichloride to form the corresponding phosphoric acid and phosphoric ester after acetic acid treatment. A table of yields related to phosphorylation conditions, temperature, and time is given. M.P.G.

N64-23006 Joint Publications Research Service, Washington, D.C.

ACETYLENIC-BENZENE SOLUTION POLYMERIZATION USING TRI-BORON FLUORIDE AS CATALYST

Liu Yu-Ch'eng, Wu Hsuan-Ch'ih, Chao Chi-yi, and Ku Hung-Sheng *In its* Transl. on Communist China's Sci. and Technol. no. 86 25 May 1964 p 18–22 refs (See N64-23001 16-01) OTS: $0.75

Experiments indicating that acetylenic benzene (vinyl benzene) can be polymerized using boron fluoride gas as the catalyst are reported. The resulting polyacetylenic benzene is of relatively high molecular weight and is insoluble in common organic solvents. Infrared spectra of the benzene insoluble fraction suggest the possibility of a linear structure. M.P.G.

N64-23007 Joint Publications Research Service, Washington, D.C.

32 NEW POLYTYPES (POLYMORPHS) OF SILICON CARBIDE

Kuo Ch'ang-lin *In its* Transl. on Communist China's Sci. and Technol. No. 86 25 May 1964 p 23–28 refs (See N64-23001 16-01) OTS: $0.75

Thirty-two polytypes of SiC have been determined by using the Laue method of X-ray analysis. A reciprocal lattice points method is proposed for the detailed analysis of the corresponding arrangements of the reciprocal lattice point in both derived and simple polytypes and for the structural determination of polytypes. A table of possible lattice spot combinations of rhombohedral polytypes of xR and simple polytype 6H is presented as an example. It is proven, within experimental error, that the calculated combinations of reciprocal lattice spots are identical to the corresponding diffracted lattice spots of Laue photographs. The crystallographic data and physical properties of the newly discovered SiC polytypes are tabulated. M.P.G.

N64-23096 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MEASUREMENT OF GAMMA RADIATION DOSE FROM OPTICAL ACTIVITY VARIATION OF CARBOHYDRATES

Sh. A. Ablyayev, V. V. Generalov, and S. V. Starodubtsev 29 Mar. 1963 10 p refs Transl. into ENGLISH From Tr. Tashkentsk. Konf. po Mirnomy Ispol'z. At. Energii (USSR), v. 1, 1961 p 159–163
(FTD-TT-63-317/1+2+4; AD-402453)

Discussed are methods of measurement of gamma radiation doses from optical activity variation of carbohydrates. The current known methods are described, and further research into the matter to simplify the techniques is presented. G.D.B.

N64-23129* National Aeronautics and Space Administration, Washington, D.C.

THERMAL TREATMENT OF POLYETHYLENE TEREPHTHALATE IN A VACUUM

Hiroshi Sobue and Atsusuke Kajiura Jun. 1964 19 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 62, no. 11, 1959 p 1766–1770
(NASA-TT-F-8889)

Polyethylene terephthalate was heated under vacuum (10^{-4} mm Hg), and the product gas was examined for its mass spectrum, infrared absorption spectrum, gas chromatography curve, and other features. The gaseous products have been found to contain CO_2, CO, H_2, diethyl ether, and other substances. The mass spectra of the total gas have been used to deduce the activation energies for the production of H_2, CO_2, and total gas, which are 24.7, 27.6, and 16.1 kcal/mole, respectively. The presence of traces of CCl_4 gives rise to benzene in the product gas. The thermal crystallization of the polymer is detected from the X-ray diffraction pattern. The variation in the viscosity parameters [η] and k' is also reported. Author

N64-23243 Olin Mathieson Chemical Corp., New Haven, Conn. Organics Div.

PERCHLOROCARBORANE AND PERCHLORONEOCARBORANE

Hansjuergen Schroeder, Joseph R. Reiner, Roy P. Alexander, and Theodore L. Heying Apr. 1964 7 p refs Submitted for Publication
(Contract Nonr-3395(00)))
(TR-20; AD-436269)

Direct chlorination of carborane and neocarborane results in undecachlorocarborane and dechachloroneocarborane, respectively, as the ultimate products. To achieve perchlorination, it became necessary to devise other methods to introduce the additional chlorine atoms. This report discusses how metal and ammonium salts of polychlorocarboranes and neocarboranes can be chlorinated to yield the perchlorinated compounds in quantity. G.D.B.

N64-23244 Olin Mathieson Chemical Corp., New Haven, Conn. Organics Div.

A NEW SERIES OF ORGANOBORANES. V: SOME CHEMISTRY OF CYCLIC SILYL CARBORANES

Stelvio Papetti, B. B. Schaeffer, H. J. Troscianiec, and Theodore L. Heying Apr. 1964 21 p refs Submitted for Publication
(Contract Nonr-3395(00))
(TR-21; AD-436270)

When the carbons of carborane participate in exocyclic rings, the thermal rearrangement of the ortho carborane nucleus to the meta configuration is opposed. These molecules as a whole therefore resist degradation at elevated temperature. Chemically, these cyclics are stable under acid conditions, but the silicon-carborane carbon bond is attacked by bases. Additional types of cyclic silazanes are reported, and reactions of some functional groups at the silicon atoms are described. Author

N64-23245 Olin Mathieson Chemical Corp., New Haven, Conn. Organics Div.

A NEW SERIES OF ORGANOBORANES. VI: THE SYNTHESIS AND REACTIONS OF SOME SILYL NEOCARBORANES

Stelvio Papetti and T. L. Heying Apr. 1964 11 p refs Submitted for Publication
(Contract Nonr-3395(00))
(TR-22; AD-436271)

The preparation and some reactions of silyl neocarboranes are reported. These derivatives contrast the isomeric silyl carboranes, since they do not tend to form exocyclic derivatives. Some differences in reactivity of chlorosilyl neocarboranes when compared with the similar carboranes are noted. Author

N64-23246 Olin Mathieson Chemical Corp., New Haven, Conn. Organics Div.

PARA-CARBORANE

Selvio Papetti and Theodore L. Heying Apr. 1964 7 p refs Submitted For Publication
(Contract Nonr-3395(00))
(TR-23; AD-436268)

Two of the three possible geometrical isomers for the icosahedral carborane system, carborane (ortho) and neocarborane (meta) were previously reported, leading to this investigation of the third possible isomer, paracarborane. The

mass spectrum of paracarborane was typical of a carborane derivative with the expected cutoff peak appearing at 144 mass units. G.D.B.

N64-23603 Missouri U., Columbia School of Mines and Metallurgy
THE DISSOLUTION OF DEFORMED MAGNESIUM IN SULFURIC ACID
W. J. James, M. E. Straumanis, and W. J. Daniels Mar. 1964 15 p refs
(Contract Nonr-2296(03))
(TR-7; AD-436100)

A study has been made of the effect of the deformation of pure polycrystalline magnesium undergoing anodic dissolution in sulfuric acid. In 0.05 and 0.10 N H_2SO_4, deviations from linearity in anodic dissolution rate versus current density plots occur at approximately 18 and 40 ma cm^{-2}. Examination of the metal surfaces following dissolution reveals a black to gray film (probably containing dispersed metallic particles) forming above and in the region of these current densities. The maximum points in the difference effect, Δ, curves for deformed metal anodically dissolving in 0.05 and 0.10 N H_2SO_4 are found at approximately 14 and 38 ma cm^{-2}, respectively. Author

N64-23662 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
JOURNAL OF PHYSICAL CHEMISTRY (SELECTED ARTICLES)
10 Jan. 1963 24 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (USSR), v. 36, no. 5, 1962 p 989–992, 1089–1094
(FTD-TT-62-1462/1+2+4; AD-295773)

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1. ELECTROSYNTHESIS OF OZONE V. G. Samoylovich, V. P. Vendillo, et al p 1–8 refs (See N64-23663 16-07)
2. POLAROGRAPHIC STUDY OF BOROHYDRIDES OF ALKALI METALS K. N. Mochalov and G. G. Gil'manshin p 9–21 refs (See N64-23664 16-07)

N64-23663 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTROSYNTHESIS OF OZONE. V. OZONE SYNTHESIS IN A STREAM UNDER REDUCED PRESSURE
V. G. Samoylovich, V. P. Vendillo, and Yu. V. Filippov *In its* Journal of Phys. Chem. 10 Jan. 1963 p 8 refs (See N64-23662 16-07)

The kinetics of ozone synthesis in a gas stream, at reduced pressure, was studied. The kinetic curves in this case have a form anomalous to the maxima for such curves. An explanation of this form of kinetic curves was proposed that takes into account the ozone decomposition outside of the ozonizer. If the ozone decomposition occurs outside of the ozonizer, then the maxima of the kinetic curves are the result of the competition between the mass and counterdiffusion flows. The difference between the dependence of ozone formation in the ozonizer and decomposition outside of the ozonizer can be the cause of the maxima in ozone decomposition outside of the ozonizer. I.v.L.

N64-23664 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
POLAROGRAPHIC STUDY OF BOROHYDRIDES OF ALKALI METALS
K. N. Mochalov and G. G. Gil'manshin *In its* Journal of Phys. Chem. 10 Jan. 1963 p 9–21 refs (See N64-23662 16-07)

Results of this study indicate the following: (1) The contradiction in the literature regarding the half-wave potential of $NaBH_4$ has been resolved. It has been established that $NaBH_4$, KBH_4, $LiBH_4$, and $CsBH_4$ give rise to one and the same anode wave with the potential of $E_{1/2} = 0.65$ v. A change in the pH of the medium and in the temperature of between 15° to 35° C has no marked effect on the value of the potential. (2) The height of the wave depends greatly on the pH and varies atibatically with the pH. At a pH > 12.5 (i.e., under conditions when, practically speaking, no hydrolysis of the BH_4^- ions is taking place) there is no polarographic wave. The wave arises under the action of factors that cause and accelerate the hydrolysis; such factors are acidification, heating, and catalysis. (3) The "borohydride" wave on the volt-ampere curve is attributable not to the BH_4^- ion, but to one of the products of its hydrolysis, presumably the $BH(OH)_3^-$ ion, and is therefore actually a "hypoborate" wave. (4) The nature of the kinetic curves, polarographically recorded for $NaBH_4$ and KBH_4, shows that the hydrolysis of these compounds proceeds in accordance with the theory of the kinetics of consecutive reactions. I.v.L.

N64-23911* Geophysics Corp. of America, Bedford, Mass.
PLANETARY PHYSICS. II: LABORATORY STUDIES OF THE CHEMILUMINESCENCE FROM THE ATOMIC OXYGEN-NITRIC OXIDE REACTION UNDER UPPER ATMOSPHERIC CONDITIONS
N. Jonathan and G. Doherty Washington, NASA, Jul. 1964 30 p refs
(Contract NASw-840)
(NASA-CR-67) OTS: $1.25

The atomic oxygen–nitric oxide reactions were studied at pressures similar to those that exist in the region of the airglow. Conclusions of the study are as follows: (1) The atomic oxygen–nitric oxide reaction is a three-body process down to pressures of at least 1μ. (2) The light-emitting reaction is not pressure dependent, and hence the existing rate constant for light emission of 1.7×10^{-17} cc $molecule^{-1}$ sec^{-1} may be applied at total pressure as low as 1μ. (3) Provided that nitric oxide is present in concentrations of 10^8 molecules/cc over the altitude range 80 to 110 km, there should be sufficient light emitted to make the atomic oxygen–nitric oxide reaction a prime contributor to the nighttime airglow continuum. P.V.E.

N64-23937* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE STRUCTURE OF $C_2B_5H_7$
Robert A. Beaudet and Robert L. Poynter Mar. 1964 3 p refs Repr. from J. of the Am. Chem. Soc., v. 86, 20 Mar. 1964 p 1258–1259
(Contract NAS7-100)
(NASA-CR-56465; JPL-TR-32-609)

Standard microwave spectroscopic methods were employed to study the molecular structure of 2,4-dicarbaheptaborane($C_2B_5H_7$). This molecule has the form of a pentagonal bipyramid with two nonadjacent carbon atoms located in the pentagonal base. The five isotropic species were analyzed, and the most stable structure was determined. J.L.D.

N64-24011 Rock Island Arsenal Lab., Ill.
SURFACE CHEMISTRY OF SOME LUBRICANT ADDITIVES
S. Fred Calhoun and Max T. Fisher 24 Jan. 1964 17 p refs
(Rept.-64-232; AD-434204) OTS: $0.75

Eleven compounds or combinations of compounds were studied in this investigation. They were added to white mineral

oil and evaluated for their effect upon the lubricative properties of the oil. The results were a positive but varied improvement for all additives. Six of them were tritiated, and their absorption on bearing steel specimens were studied by radioactive counting. An increase in temperature and humidity resulted in variable increases in absorption. It was observed that on static storage some of the additives apparently settled in the lubricant without forming a precipitate. Others formed a visible precipitate. In either case, their effect upon the lubricant was appreciably diminished. Degreasing with trichloroethylene seemed to eliminate the lubricative ability of the additive even though radioactive counting disclosed some still to be present on the degreased test specimen. Author

N64-24226 Wisconsin U., Madison
MOLECULAR CATALYSIS AND INTERACTIONS IN AQUEOUS SOLUTIONS Final Report, Jan. 1, 1963–Jan. 31, 1964
Takeru Higuchi 24 Mar. 1964 59 p refs
(Contract DA-18-108-AMC-88A)
(AD-437607)

This investigation deals with the determination of whether the aging reaction observed for cholinesterase, inhibited by phosphorylating agents, could be simulated by a model system composed of catalytic species and a known inhibitor. On the basis of its structure, 3-nitrocatechol was selected as the simulant for the enzyme in its reaction with Sarin (isopropyl methyl phosphonofluoridate). The kinetics and mechanism of the hydrolytic cleavage of the resulting intermediate ester product, isopropyl 3-nitro-*o*-hydroxyphenyl methyl phosphonate, were in the pH range of 2.5 to 13.5. The mechanism of hydrolysis, as determined kinetically and by product isolation, indicated that the major reaction, primarily responsible for the hydrolytic cleavage in the pH range of 2.5 to 8.0, closely resembled the process apparently responsible for the irreversibility gradually produced in the freshly inhibited enzymes.
I.v.L.

08 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; telemetry; tracking; and wave propagation. *For tracking stations see*: 10 Facilities, Research and Support. *For related information see*: 06 Auxiliary Systems; 09 Electronics; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-22782* Aeronutronic, Newport Beach, Calif.
EXPERIMENTAL STUDIES FOR THE DETECTION OF PROTEIN IN TRACE AMOUNTS (J-BANDS) Second Quarterly Status Report, 1 May 1962–31 Jul. 1962
R. E. Kay [1962] 3 p
(Contract NASr-84)
(NASA-CR-56522; QLR-62-16) OTS: $1.10 ph

The influence of pH on the intensity of the J-band formed in the presence of proteins was determined by mixing gelatin and 0.001M cacodylic acid or tris buffers with 3,3' diethyl −9 methyl 4,5,4',5' dibenzothiacarbocyanine bromide (dye 1). It was found that, over the pH range 5.2 to 8.8, the intensity of the J-band was not appreciably altered. The intensity of J-bands formed with E. *coli* suspensions and gelatine solutions in cacodylic acid buffer (pH 7.0) was investigated as a function of protein concentration. In each case, as little as 0.00005% protein gave an easily detectable J-band and increasing the protein concentrations, up to at least 0.1%, gave rise to progressively more intense bands. The interaction of the dye with pyrimidine and purine bases, nucleosides and nucleotides was investigated at pH 7.0. Only the nucleotides altered the absorption spectrum of the dye, and for each nucleotide tested an intense J-band was formed. The behavior of 3,3'-dimethyl 4,5,4'5' dibenzo-9 ethyl-thiacarbocyanide chloride with gelatin, sulfate, and nucleotide solutions was investigated. It was found that this dye forms an intense J-band at 650 mμ in the presence of these substances and that its sensitivity to sulfate ions was considerably greater than that of dye 1.
P.F.E.

N64-22905 Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
ERROR ANALYSIS OF PHASED-ARRAY DIRECTION FINDERS
John D. Bruce 18 Feb. 1963 49 p refs
(Contract DA-36-039-SC-87499)
(EDL-E79; AD-600429)

An antenna array using multiple beams for direction finding has certain inherent errors associated with its use. Two error expressions are employed to give a measure of the accuracy obtained with this antenna system. One of these is called the maximum average error and the other the expected error. Five different operating conditions are investigated. They are: (1) the ideal case, where all beams are assumed to have the same form; (2) the unequal beamwidth case, where the effect of broadening the beam pattern when directed away from broadside is considered; (3) the unequal gain, equal beamwidth case that considers the effect of receiver gain imbalance; (4) the unequal gain, unequal beamwidth case, which is a combination of the effects of the second and third above conditions; and (5) the random signal detection case, which treats the problem of certain intercepts remaining undetected. Comparisons are made with the ideal case for all nonideal operating conditions and are displayed in graphical form. The effect of beam broadening is shown to be quite small. Author

N64-22915 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
PARTIAL REFLECTIONS IN THE ATMOSPHERE AND LONG-DISTANCE PROPAGATION
Francois Du Castel, Pierre Misme, and Jean Voge 22 Apr. 1964 17 p refs Transl. into ENGLISH from Ann. Telecomm. (France), v. 13, no. 7–8, 1958 p 209–214
(RSIC-166; AD-600685)

A brief outline is given of the theories capable of explaining the electric field observed at a great distance beyond the visibility zone. The conclusion is reached that each theory is valid for a particular atmospheric model. Discussed are the results of measurements, made in France and abroad, that demonstrate the existence of layers characterized by abrupt variations of the index of refraction, called "lamina." These layers appear to exist permanently in all parts of the globe, but their characteristics vary with the meteorological situation.
Author

N64-22972 Air Force Systems Command, Bedford, Mass. Electronic Systems Div.
AIRBORNE INSTRUMENTATION PLATFORM FEASIBILITY STUDY RESULTS
Jan. 1964 56 p
(ESD-TDR-64-182; AD-427827)

The results of a feasibility study to determine the utility of an airborne instrumentation platform for making tracking measurements on satellite and spacecraft trajectories are presented. This report considers an analysis of the capability

of a system, to be developed through the integration of state-of-the-art sensor (radar and optical), communication, navigation, data processing, and telemetry equipment, to satisfy the tracking measurement requirements of typical orbital profiles. Author

N64-23083 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE THEORY OF FUNCTIONAL GENERATORS WITH CATHODE RAY TUBES
O. I. Petrenko *In its* Automation 14 Feb. 1963 refs p 27-47a (See N64-23080 16-17)

Transforming a graphic image of an analytical or experimentally obtained function of a certain variable in the form of an electric load for subsequent use as measurements and adjustment of various equipment, or for introduction into computers is discussed. The best known one is the photoformer, in which the ray of the CRT, used as an element of the followup system, runs along the edge of the profile of the mask applied to the screen of the tube. The photoformer can be used wherever the intention is to generate electric pulses of some form or another, but basically it is used in electron modulating devices. Accuracy of no less than 0.5% to 1%, as well as rapid action, is required of the photometer to assure the increase time of the output load of 1% or less of the entire time of determination; at a determination time of 10 msec, the application of a photoformer requires a passband of more than 5 kc; for a satisfactory repetition of results, the level of output noise should be 60 to 80 db of maximum output amplitude. Author

N64-23088 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CODE FREQUENCY-COMBINATION SYSTEM FOR TELEMETERING
B. S. Didyk and F. O. Katkov *In its* Automation 14 Feb. 1963 refs p 83-87 (See N64-23080 16-17)

A code frequency-combination telemetry system is described that possesses high speed and interference resistance characteristics. Parallel codes are formulated by compiling combinations of *n* through *m* frequencies that are sent simultaneously. In contract to code-pulse systems, the high-frequency signal (which corresponds to the given value of the primary measured value) is sent by a transmitter and continuously fixed by the receiving device so that any component failure is immediately detectable. The primary metering device transforms the measured value into an angle of rotation or linear displacement. An indicator unit in the primary measuring device consists of a light source and mirror combination; the degree of deflection of the reflected light beam is detected by photoelectric converters that activate the corresponding input zones of the commutator. This system is entirely contactless. M.P.G.

N64-23294 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE RELIABILITY OF COMMUNICATIONS ENGINEERING HARDWARE
J. Katona 18 Feb. 1963 16 p Transl. into ENGLISH from Nachrichtentechnik (E. Berlin), no. 2, 1962 p 68-71
(FTD-TT-62-1820/1+2+4; AD-299667)

The problems of investigating the longevity of passive structural components, such as resistors, capacitors, and potentiometers, are presented. A discussion of the basic concepts and methods of longevity research as well as the statistical methods used are included. R.T.K.

N64-23357 University of Southern Calif., Los Angeles
MAXIMUM LIKELIHOOD ESTIMATION OF PARAMETER CHANGES IN NOISY SIGNALS Interim Technical Documentary Report
R. M. Gagliardi Feb. 1964 30 p refs
(Contract AF 04(695)-304)
(USCEE-106; SSD-TDR-64-68; AD-436108)

This report considers the application of maximum likelihood principles for estimating the time of occurrence of parameter changes; i.e., the time at which a signal of one parameter changes to a signal of another parameter, when imbedded in noise. The primary assumption is that the signals and/or the parameters are known a priori. Two cases are given particular attention: (1) when the signal is known and the parameter corresponds to signal amplitude; and (2) when the signal is random and the parameter corresponds to its covariance. In general, the ability to estimate time of parameter change depends directly upon the difference of energy in the signal before and after the change. Author

N64-23358 Dynatronics, Inc., Orlando, Fla.
TELEMETRY PREDETECTION RECEIVER RECORDER/REPRODUCER SYSTEM Final Report
H. Howe et al Patrick AFB, Fla., Missile Test Center, Dec. 1963 121 p
(Contract AF 08(606)-4500)
(MTC-TDR-63-11; AD-436029)

Design and development of the Telemetry Predetection Receiver Recorder-Reproducer System are discussed. The report is divided into parts. The first part describes the technical problems encountered, the solutions to these problems, and the practices employed in design, fabrication, and testing of the system. The second part describes the engineering effort in and the design and development of the system. The various design approaches to the many complex problems are likewise summarized, and principal conclusions reached as a result of the effort are outlined. The third section presents a comparison of the original design goals and the final test data. The telemetry predetection system is to be utilized as follows: (1) to simultaneously receive up to four links of telemetry RF signals transmitted in any type of modulation; (2) to amplify and convert these signals to an intermediate frequency; (3) to magnetically record the IF and detected video signals; and (4) to provide demodulation of the received and recorded IF signals. P.V.E.

N64-23419 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MULTICHANNEL TELEMETRY DEVICE
S. V. Alekseyev 14 Mar. 1963 5 p Transl. into ENGLISH from Soviet Patent No. 148448, 28 Feb. 1961
(FTD-TT-63-95/1+2+4; AD-400542)

A multichannel telemetry device is described that has pulse-amplitude modulation of the transmitted pulse signals and synchronized communication channels at the receiving and transmitting stations. It contains a circuit for producing scaling signals at the transmitting station and a circuit for producing standard signals at the receiving station. G.D.B.

N64-23607 Illinois U., Urbana Coordinated Science Lab.
SUPPRESSION OF NOISE EFFECTS IN PULSE WIDTH MODULATED SYSTEMS
H. J. Stein Jan. 1964 54 p refs
(Contract DA-36-039-AMC-02208(E))
(R-190; AD-437495)

Investigation is made of a sampled data feedback system, consisting of a lead-type pulse-width modulator, a general

(n-th order), linear, time-invariant plant, and unity feedback. The closed-loop system is assumed to be stable, and it is assumed that plant time constants are of the order of, or shorter than, the pulsing period. The modulator is assumed to be imperfect (noisy), in that it emits pulses, the durations of which differ from the correct values. The deviation of the pulse width is assumed to be a gaussian random variable with zero mean and a given standard deviation, and it is assumed that there is no correlation between samples at different sampling instants. Equations are derived predicting the probability distribution of the plant output after any number of sampling instants. These equations are used to design a feedback controller that minimizes, statistically, the deviation of the plant output from its correct (noiseless modulator) value. The controller is designed to operate autonomously, and is therefore effective only for the regulator system. The equations are further used to design an auxiliary controller that is placed in parallel with the modulator. This controller is capable of reducing the effect (on the output) of noise in the modulator to an arbitrarily small value, and is not limited to the regulator system. Author

N64-23790 Joint Publications Research Service, Washington, D.C.

EQUATION OF THIN CYLINDRICAL ANTENNA IN A PLASMA WITH ALLOWANCE FOR SPATIAL DISPERSION

V. Ya. Eydman *In its* Izv. VUZov: Radiophys. 18 May 1964 p 78–83 refs (See N64-23783 16-28) OTS: $5.00

The problem of excitation of a thin cylindrical (wire) antenna placed in plasma is considered, taking into account spatial dispersion, i.e., plasma wave generation. Author

N64-23791 Joint Publications Research Sevice, Washington, D.C.

SOME CORRELATION RELATIONS UPON REFLECTION OF A SOUND WAVE FROM A STATISTICALLY ROUGH SURFACE

E. P. Gulin *In its* Izv. VUZov: Radiophys. 18 May 1964 p 84–99 refs (See N64-23783 16–28) OTS: $5.00

Expressions have been obtained for the spatial autocorrelation coefficient of amplitude and phase fluctuations in the sound wave, reflected from a perfectly soft statistically rough surface. The autocorrelation interval of surface nonuniformities is small compared with Fresnel's zone. The case of a mutual correlation of the amplitude and phase fluctuations is also considered. Author

N64-23792 Joint Publications Research Service, Washington, D.C.

DIFFRACTION OF THE FIELD OF A RADIATING SURFACE ANTENNA EXCITED BY ELEMENTARY DIPOLE BY SOME SOLIDS OF REVOLUTION

Ye. A. Ivanov *In its* Izv. VUZov: Radiophys. 18 May 1964 p 100–117 refs (See N64-23783 16-28) OTS: $5.00

Diffraction of a surface antenna field on metallic spheroid, sphere, or disk is considered. The field is excited by an elementary electric dipole situated on the perfectly conducting surface of the antenna, and the dipole moment is parallel to the rotation axis of the solids. Author

N64-23793 Joint Publications Research Service, Washington, D.C.

CONCERNING THE USE OF LOW-NOISE AMPLIFIERS IN SPECTRAL RADIOMETERS

E. V. Borodzich and R. L. Sorochenko *In its* Izv. VUZov: Radiophys. 18 May 1964 p 118–127 refs (See N64-23783 16-28) OTS: $5.00

Discussed is a zero spectral radiometer that uses the zero method of continuous radiation reception and the differential method of spectral line separation above white noise. The fluctuation sensitivity is calculated, and the possible interfering effects of the radiometer are analyzed. Author

N64-23794 Joint Publications Research Service, Washington, D.C.

DISPERSION PROPERTIES OF AN OBLIQUE HELIX OF RECTANGULAR CROSS SECTION

V. N. Ivanov *In its* Izv. VUZov: Radiophys. 18 May 1964 p 128–135 refs (See N64-23783 16–28) OTS: $5.00

A dispersion equation has been obtained of an oblique helix with a rectangular cross section in the approximation of an anisotropically conductive surface. By an approximate solution of the dispersion equation the retardation has been found dependent on the magnitude of the free-space wave number. Author

N64-23796 Joint Publications Research Service, Washington, D.C.

NOISY ELECTRON BEAM IN A SYSTEM OF EXCITED RESONATORS

A. S. Roshal *In its* Izv. VUZov: Radiophys. 18 May 1964 p 145–161 refs (See N64-23783 16–28) OTS: $5.00

The equations for an electron beam passing through a system of coupled resonators with emf are presented in matrix form. The matrix of the input noise spectral densities is given. Author

N64-23797 Joint Publications Research Service, Washington, D.C.

BROADENING OF THE NOISE SUPPRESSION BAND IN A QUADRUPOLE AMPLIFIER WITH THE AID OF A SYSTEM OF UNCOUPLED RESONATORS AT THE INPUT

M. M. Kovalevskiy and A. S. Roshal *In its* Izv. VUZov: Radiophys. 18 May 1964 p 162–171 refs (See N64-23783 16-28) OTS: $5.00

Discussed is the expansion of the fast cyclotron wave noise suppression band in a quadrupole amplifier by means of a system of uncoupled resonators with a uniform transverse field (in comparison with the analogous single resonator). Author

N64-23806 Joint Publications Research Service, Washington, D.C.

WIDTH OF SPECTRAL LINE OF SOME LOW FREQUENCY AND RADIO FREQUENCY OSCILLATORS

D. A. Dmitrenko and A. I. Chikin *In its* Izv. VUZov: Radiophys. 18 May 1964 p 281–284 refs (See N64-23783 16-28) OTS: $5.00

The width of an oscillator's spectral line, one of the characteristics of its instability, was previously measured in the high mc range. In this article, data are presented on the width of the spectral line of generators in the radiofrequency, ultrasonic, and audio bands, including quartz-controlled generators. G.D.B.

N64-23935* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DETERMINATION OF THE TRIAXIALITY OF THE EARTH FROM OBSERVATIONS ON THE DRIFT OF THE SYNCOM II SATELLITE

C. A. Wagner Apr. 1964 57 p refs

(NASA-TM-X-55003; X-621-64-90) OTS: $5.60

The triaxiality of the earth is studied from observations on the drift of the Syncom II satellite. The earth must be considered a triaxial ellipsoid for the purpose of a 24-hour satellite design, and the difference between the major and minor equatorial radii of the ellipsoid is not less than 200 ft nor greater than 225 ft. The location of the major equatorial axis of the triaxial geoid is between 13° and 25° west of Greenwich. The study of simulated 24-hour satellite drift in a triaxial earth field, influenced also by sun and moon gravity and by sun-radiation pressure perturbations, shows that the theory of longitude drift presented is substantially unaffected by all perturbation except that due to the earth's elliptical equator and possible higher order longitude-dependent earth-gravity anomalies. J.R.C.

N64-23986* Hughes Research Labs., Malibu, Calif.

PRELIMINARY STUDY OF MODULATION SYSTEMS FOR SATELLITE COMMUNICATIONS Report No. 6

S. Plotkin Feb. 1963 50 p refs

(Contract NASw-495)

(NASA-CR-56286) OTS: $4.60

A comparative study of power and bandwidth requirements for SSB, FM, and PCM modulation systems for multiple-access satellite communications is given. It is shown how a comparison of information efficiencies can be utilized. These efficiencies are a comparison of each modulation system with SSB, which was taken as 100%. Conclusions are that frequency division multiplexing is most advantageous and that FM is somewhat superior to PCM for the S/N ratios required, even neglecting practical difficulties. One other result is that system bandwidth increases with the number of channels, whereas peak power requirements are practically constant for one to 150 channels in SSB and FM systems. Author

N64-24089 ITT Communication Systems, Inc., Paramus, N.J.

RESTORAL PRINCIPLES IN A WIDEBAND DISTRIBUTED NETWORK Final Report

12 Jul. 1963 11 p

(Contract AF 19(626)-5)

(ICS-63-TR-201; ESD-TDR-64-258; AD-435772)

The 48 kc automatic group restoral system recommended for use with CONUS, Alaska, and Canada is based on the use of a directory at each node with each node having full knowledge of the status of each network link. This particular configuration is recommended because it permits maximum use of all telecommunication resources included with the restoral system. J.R.C.

N64-24102* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

THE RANGER 5 FLIGHT PATH AND ITS DETERMINATION FROM TRACKING DATA

W. L. Sjogren, W. E. Kirhofer, D. L. Cain, W. R. Wollenhaupt, and T. W. Hamilton 6 Dec. 1963 139 p refs

(Contract NAS7-100)

(NASA-CR-56567; JPL-TR-32-562) OTS: $10.50 ph

This report describes the current best estimate of the Ranger 5 spacecraft flight path and the way in which it was determined. The spacecraft was tracked in the two-way doppler mode until 8 hr after launch, when the batteries were depleted. The transmitter in the rough-landing capsule was tracked for 11 days after launch, except during occultation by the moon. It is concluded that a small maneuver took place along the sunline near the time that power depletion terminated contact with the spacecraft. A new orbit determination program that treats the effects of station location and physical constant errors was used to estimate the flight path. Author

N64-24186 Aerospace Corp., El Segundo, Calif. Electronics Div.

THEORETICAL ERROR ANALYSIS OF THE SCF AUGMENTED DOPPLER TRACKING SYSTEM

A. H. Shapiro 8 May 1964 51 p refs

(Contract AF 04(695)-269)

(SSD-TDR-63-339; TDR-269(4110-01)-12; AD-601579)

This study determines how accurately the 375/400 mc Doppler tracking system, presently implemented in the augmented SCF network, can theoretically be expected to perform. A theoretical analysis and evaluation are presented of all known errors associated with equipment performance parameters, data conversion processes, and data interpretation. Representative low, medium, and high altitude orbits are considered in order to demonstrate how the calculated errors will vary throughout the full range of orbital altitudes of interest. Author

N64-24207 Texas U., Austin Electrical Engineering Research Lab.

A COMMUNICATION SYSTEM AND THEORY FOR INVESTIGATION OF EM WAVE PROPAGATION IN THE EARTH AT FREQUENCIES FROM 0 TO 3000 CPS Final Report

Darrell R. Word and Frederick W. Patrick 28 Feb. 1964 121 p refs

(Contract AF 19(604)-8513)

(TR-6-60; AFCRL-64-179; AD-601519)

This report describes a 40 kw transmitter designed for investigating electromagnetic wave propagation in the earth at frequencies from d.c. to 3,000 cps. The transmitter uses a dipole antenna consisting of two surface electrodes between which a current can be passed through the earth. A brief description of the receiving equipment and some experimental data are included, and a discussion of the related theory and field strength prediction is given. Author

N64-24233 Raytheon Co., Waltham, Mass. Research Div.

STUDY OF MICROWAVE GENERATION BY MEANS OF ELECTRON BEAM INTERACTION WITH ANISOTROPIC MEDIA Third Quarterly Progress Report, 1 Jan.–31 Mar. 1964

S. F. Paik and R. J. Briggs [1964] 56 p refs

(Contract DA-36-039-AMC-02362(E))

(S-638; AD-601158)

The interaction between electron beams and anisotropic media is investigated as a possible means of generating microwave energy. Two particular anisotropic materials considered for the study are plasmas and pyrolytic graphite. The results of experimental work on annular plasma columns are presented. The plasma density is determined by measuring the dipole resonance using a section of a stripline. Results of the stripline measurement are used to locate the passband of the backward surface wave. The theoretically predicted forward and backward surface waves were measured. Agreement between the theory and the experiment is excellent. Attenuation of the amplitude of these waves was as high as 10 db/cm. A possible cause for the high attenuation and a method of reducing the loss are discussed. Low-frequency oscillations in

the frequency range of 100 to 200 kcs were observed in the plasma. A possible spurious oscillation resulting from electron beam interaction with the plasma body wave is considered. It is concluded that the surface-wave interaction will predominate over this spurious mode of interaction if $\omega_c < \omega_p$. A criterion for the existence of backward wave in a plasma column is derived theoretically. Experimental results of the measurement of the conductivity of PG-BN layered material are presented. The real part of the effective conductivity measured for one sample was 6×10^{-3} mho/meter. Author

09 ELECTRONICS

Includes circuits and circuit theory; electronic components (e.g., tunnel diodes, transistors, and tubes); and feedback and control theory. *For related information see*: 06 Auxiliary Systems; 08 Communications; 15 Instrumentation and Photography; 22 Navigation and Guidance; and 25 Physics, Solid-State.

N64-22798 Joint Publications Research Service, Washington, D.C.

ELECTRON-BEAM WELDING IN INDUSTRY

O. K. Nazarenko and N. N. Leont'yev 19 Jun. 1964 10 p Transl. into ENGLISH from Mashinostroyeniye, (Kiev), no. 6, 1963 p 48-52

(JPRS-25171; OTS-64-31523) OTS: $0.50

This is a general article describing electron-beam welding in Soviet industry. Experimental, specialized, and industrial installations are described and illustrated. G.D.B.

N64-22809 IIT Research Inst., Chicago, Ill.

NINTH TRI-SERVICE CONFERENCE ON ELECTROMAGNETIC COMPATIBILITY Unclassified Proceedings

Oct. 1963 782 p refs Papers Presented at Conf. Held in Cooperation with IEEE at the Museum of Sci. and Ind., Chicago, 15-17 Oct. 1963

(Contract DA-36-039-SC-89102)

(AD-434850)

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N64-22810 Genistron, Inc., Los Angeles, Calif.
FRI/EMI AT THE CROSSROADS
Fred J. Nichols *In* IIT Res. Inst. Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 45–58 (See N64-22809 16-09)

Some typical examples of the problems facing radiofrequency interference–electromagnetic interference control and detection are illustrated, and recommendations that can be used to establish RFI–EMI policies on a per program basis are presented. Also included are recommendations for obtaining RFI–EMI specifications on a per type of equipment or system basis, and on an intrasystem and intersystem basis. P.V.E.

N64-22811 Georgia Inst. of Tech., Atlanta Engineering Experiment Station
THE BEHAVIOR OF NONLINEAR MIXING
R. D. Trammell, Jr., and E. W. Wood *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 59–81 refs (See N64-22809 16-09)
(Contract DA-36-039-AMC-02294(E))

This paper discusses the effects of injected local oscillator and input signal harmonics, emphasizes their relative importance in producing responses, and demonstrates their experimental effect on mixer measurements. Possible sources of such harmonics are outlined. The absolute response level affected the relative spurious response rejection measurements for responses having large q values. A reliable mixer response prediction method based on sample response measurements is presented. Its application to receiver spurious response prediction is discussed along with associated pitfalls and limitations. The basis for method and the various relationships for its use are examined. Experimental results illustrate the accuracy of the prediction procedures to the tenth order of generation. Author

N64-22812 Hughes Aircraft Co., Fullerton, Calif. Ground System Group
MIXER ANALYSIS AND DESIGN
R. W. Long *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 82–100 (See N64-22809 16-09)

An analysis and design technique is developed that allows the analysis or design of a mixer for a specified spurious level. The procedure assumes that a maximally flat filter is used and approximates a relationship between the order and level of spurious signals. The procedure involves determining the critical spurious signals and then spacing these spurious signals from the passband by a fractional bandwidth, which will assure that the level of the spurious signals at the output of the filter will be less than or equal to the specified spurious signal level. The most straightforward application of this technique will optimize the percentage bandwidth for a given mixing ratio or spot in the

mixer chart. A method is presented to allow the bandwidth to be adjusted to any value less than the allowable bandwidth in such a way as to increase the suppression of the spurious signals equally on both sides of the filter bandpass. Where additional bandwidth is required, several techniques are suggested for lowering the spurious signal level prior to filtering. The analysis and design technique is extended to cover the case where multiple output passbands are used. This technique allows large increases in the percentage bandwidth. Examples are given of single- and double-filter design. Author

N64-22813 IIT Research Inst., Annapolis, Md. Electromagnetic Compatibility Analysis Center
OFF-TUNING EFFECTS PRODUCED BY INTERFERENCE
R. J. Mayher *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 101–119 refs (See N64-22809 16-09)
(Contract AF 19(604)-8440)

This paper considers the analysis of off-tuned pulsed interference and continuously modulated off-tuned interference. For pulsed interference, the threshold probability of detecting the off-tuned pulses is presented. For the case of a modulated interfering signal, the detected output signal as a function of the off-tuning is given. The modulated signal is considered for both an amplitude and a frequency modulated signal. Author

N64-22814 Adcom, Inc., Cambridge, Mass.
RADIO FREQUENCY INTERFERENCE IN DIGITAL TWO-PHASE COHERENT COMMUNICATION SYSTEMS
A. Krinitz. *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 120–133 refs (See N64-22809 16-09)
(Contract AF 30(602)-2528)

The evaluation of error rates due to unintentional radio-frequency interference in digital two-phase coherent communication systems requires detailed statistical data about the interference and presents a computational problem that may become prohibitive for any but the simplest forms of interference such as gaussian, CW, or impulse noise. Consequently, the least upper bound on the error rate or the probability of error derived and that can be easily evaluated from relatively simple interference data and applicable to any wide-sense stationary radiofrequency interference, including nongaussian interference, becomes a very useful performance criterion. Author

N64-22815 IIT Research Inst., Chicago, Ill.
LOW-PASS TRANSMISSION LINES FOR RFI PROTECTION
H. G. Tobin and L. J. Greenstein *In its* Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 134–154 refs (See N64-22809 16-09)

This paper deals with the analysis, design, and fabrication of transmission lines that may be used to protect electroexplosive devices from inadvertent firing. Analysis was performed in order to determine the attenuation characteristics of various transmission lines. Initial investigation was concerned with the dissipation of a conventional line. Such a line is defined as one that has no variation in geometry as a function of length, in material properties as a function of frequency, and that has a homogeneous material between its two conductors. A general technique is described for optimizing the attenuation characteristics of a distributed line in order to achieve the desired amount of RF protection. This technique is applied to the conventional line, and the optimum line parameters are derived. The attenuation of such a line will vary at a rate no greater than the square root of frequency. A more rapid change in attenuation is possible if a line utilizing two layers of dielectric is used. Author

N64-22816 White Electromagnetics, Inc., Bethesda, Md.
THE REALIZATION OF COMPATIBLE STRUCTURE GROUNDING SYSTEMS
H. W. Ervin, D. R. Lightner, and Robert Powers (RADC) *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 155–182 refs (See N64-22809 16-09)
(Contract AF 30(602)-2691)

This paper discusses the design and implementation of grounding systems that must be used in structures or complexes that house electronic equipment that are susceptible to or capable of generating electromagnetic energy. Grounding systems are analyzed as two separate entities, earth grounding system and reference plane grounding system. Criteria are developed for the design and implementation of compatible grounding systems based on both theory and practice. Author

N64-22817 Pennsylvania U., Philadelphia Moore School of Elec. Eng.
ELECTROMAGNETIC COUPLING BETWEEN COAXIAL, SINGLE-WIRE, TWO-WIRE, AND SHIELDED TWISTED PAIR CABLES
M. Kaplit *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 183–192 refs (See N64-22809 16-09)
(Contract NObsr-85170)

This paper presents the results of an experimental investigation of electromagnetic coupling between coaxial, single-wire, two-wire, and shielded twisted pair cables over the frequency range of 100 cps to 50 kc. The coupling was measured for matched, short-circuit, and open-circuit loaded cables when different combinations of similarly loaded parallel cables are used, enabling electric and magnetic coupling to be determined. These results are given as transfer impedances for different cable spacings and frequencies, worst case conditions being measured for shielded twisted pair cables. A brief summary of shielding effectiveness measurements is given. These are contrasted with the technique presented in this paper since many of them determine the shielding effectiveness of only a single cable. Author

N64-22818 Douglas Aircraft Co., Inc., Long Beach, Calif. Aircraft Div.
ACHIEVING ELECTROMAGNETIC COMPATIBILITY BY CONTROL OF THE WIRING INSTALLATION
G. J. King *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 193–204 (See N64-22809 16-09)
(Sponsored by Navy)

Controlled classification of the wiring and the bundles reduces the interaction of equipments caused by the inadvertent coupling resulting from random installation. Wire routing control is mandatory to prevent the interaction of individual systems and may also be required with wiring associated with systems that are susceptible to self-interference. The minimum design concept for adequate wiring isolation is defined. Definitive grounding of systems and the attendant grounding methods, including the bonding of all equipment installations, are a significant part of the overall compatibility of the electrical–electronic environment. Emphasis is directed toward this area. Author

N64-22819 IIT Research Inst., Annapolis, Md. Electromagnetic Compatibility Analysis Center
COMPATIBILITY ANALYSIS SENSITIVITY
H. M. Sachs and T. N. Truske *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 205–230 refs (See N64-22809 16-09)
(Contract AF 19(604)-8440)

The major requirements associated with an overall interference prediction analysis include data, either measured or synthesized, describing the pertinent emission and susceptibility characteristics of those equipments involved in a problem, and the environmental and operational constraints associated with the systems; basic mathematical models, capable of processing signals through the receivers to be analyzed; and supplementary models, capable of representing or describing overall system degradation due to such signals. These separate areas were and are being investigated in considerable detail, but relatively minor effort was expended to integrate the input data and prediction models so that the data requirements will be compatible with the modeling techniques and evaluation criteria employed. The paper deals primarily with signal emission characteristics, and their relation to the requirements of search and tracking radar interference prediction models. Several prediction output criteria were considered, with emphasis on mean probability of pulse detection, or false alarm rate, ppi scope degradation, and increase in target acquisition time. Author

N64-22820 HRB-Singer, Inc., State College, Pa.
THE ANALYSIS AND SYNTHESIS OF RADAR EMISSION SPECTRUMS BY DIGITAL COMPUTER METHODS
Robert B. Marcus *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 231–260 (See N64-22809 16-09)

A knowledge of the characteristics of previously measured spectra and the physical laws governing the characteristics are used as a guide in the synthesis procedure. A model based on the lobe structure of the radar rather than the line structure was generated in the computer. A rather slow computer, the Burrows 220, was available, and the lobe structure greatly reduced the computation time compared to that of the line structure. If a victim receiver's bandwidth is less than that of a single lobe, a modified line structure can be used. Spectra based on rectangular and trapezoidal pulses with various rise times were generated. These were compared with measured emission spectra of existing radars. It was found that the synthesized spectrum based on a trapezoidal pulse was a better fit than that based on a rectangular pulse. Author

N64-22821 IIT Research Inst., Annapolis, Md. Electromagnetic Compatibility Analysis Center
ADVANCED RECEIVER MODEL SYSTEM "ARMS"
D. H. Cook, J. L. Pierzga, and F. N. Leahy *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 261–282 refs (See N64-22809 16-09)
(Contract AF 19(604)-8440)

An advanced receiver model system (ARMS) was developed to provide the capability of handling complex interference problems with a fast reaction time. This capability was initially planned as a manual technique using the computer as a tool for providing input data to the system. The means of obtaining receiver selectivity curves, spurious response levels, and shapes of the spurious responses are discussed. Details of the method for handling any special circuits included in the receiver (over a normal matched filter receiver) are described. The methods used for treating a pulse compression receiver are presented as an example. Author

N64-22822 Pennsylvania U., Philadelphia Moore School of Elec. Eng.
COMPUTER PROCESSING OF ANTENNA PATTERNS
H. N. Kritikos and M. R. Dresp *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 283–294 refs (See N64-22809 16-09)
(Contract AF 30(602)-2888)

This paper demonstrates the usefulness of electronic digital computers in reducing antenna pattern data. Three methods of simplifying the data and the error involved in the simplification are examined—reduction of the pattern to constant gain sections, simplification by band limiting the spherical harmonic spectrum, and the determination of the probability distribution function of the gain. Author

N64-22823 Stanford Research Inst., Menlo Park, Calif.
THE USE OF DIRECTIONAL COUPLERS AS HARMONIC PADS
L. Young *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 295–309 refs (See N64-22809 16-09)
(Contracts AF 30(602)-2734; AF 30(602)-3174)

Interference caused by the radiation of harmonic frequencies from high-power transmitters can be reduced or eliminated by using filters external to the high-power tube. The most compact filters are usually rejection filters that operate by reflecting, rather than absorbing, all or most of the unwanted frequencies. To protect the tube from the reflected harmonic power and to avoid harmonic resonances in the line, it is then advisable to use a harmonic pad between the transmitter and the rejection filter. It is possible to adapt 3-db and 0-db directional couplers for use as harmonic pads. Author

N64-22824 Sperry Microwave Electronics Co., Clearwater, Fla.
A STANDARD RESPONSE INDICATOR FOR PULSED SYSTEMS
N. R. Free and L. A. Hill *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 310–319 (See N64-22809 16-09)
(Contract AF 30(602)-2539)

This paper describes a new instrument for use with pulsed systems, which indicates electronically and visually the signal plus noise to noise ratio, (S+N)/N, of a system receiver video output. The portable self-contained unit is fully transistorized, and was designed as part of the AN/MSM-63 (XW-1) spectrum signature measurement equipment. The electronic indication consists of a d.c. step whenever (S+N)/N is above a preselected limit (or within upper and lower limits), while the visual indication consists of a meter calibrated in db that registers the detected ratio. By utilizing this instrument it is possible to eliminate human operator judgment in determining the actual level of a desired receiver response. Thus, the reliability and repeatability of such measurements are greatly enhanced when this standard response indicator is incorporated into a measurement technique. Author

N64-22825 Polarad Electronics Corp., Long Island City, N.Y.
RI/FI INSTRUMENTATION TO 21 GC.
S. Abrams and B. Leibowitz *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 320–325 refs (See N64-22809 16-09)
(Contract AF 33(600)-41420)

This paper discusses the development of instrumentation to increase the frequency range of the standard 1- to 10-Gc

model FIM field intensity meter to 21 gc. The calibrated receiver consisted of a basic unit and four plug-in heads to cover the 1- to 10-Gc range. The selected head received the RF input signal and converted it to a 260-mc IF signal that was then passed on to the basic unit. This discussion is limited primarily to the development of two additional heads required to give the increased frequency coverage from 10 to 21 Gc. Author

N64-22826 Georgia Inst. of Tech., Atlanta
TRACKING NOTCH FILTER FOR THE REJECTION OF CW INTERFERENCE
N. B. Warren, Jr. *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 326–339 (See N64-28809 16-09)
(Contract AF 30(603)-2904)

A tunable, single frequency rejection filter is described, which uses a phase locked oscillator to obtain a narrow rejection notch in the region of 455 kc. The notch response is obtained by canceling the signal to be rejected with a locally generated signal of equal amplitude and opposite phase. Automatic phase and amplitude control of the cancellation signal permits the rejection notch to automatically track frequency and amplitude changes of the signal being rejected. A notch width of less than 100 cycles is maintained over a 10-kc bandwidth centered at 455 kc. The cancellation of single frequency signals exceeds 50 db. Author

N64-22827 Bell Aerosystems Co., Tucson, Ariz.
COMPARISON OF TRANSMITTER SPECTRUM SIGNATURE DATA AND RADIATED FIELD STRENGTH DATA FOR TRANSMITTER EMISSIONS
P. F. Chen and C. E. Blakely *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 340–357 refs (See N64-22809 16-09)

This paper discusses the development and present status of the work being done to compare the transmitter spectrum signature data, using a resistive load and the transmitter radiated-emission-level data using an electrically short whip antenna mounted on a tactical military vehicle. A review of previous work in the area of analyzing these data by others is also presented. A description of the transmitter emission level data collection procedure as well as the test transmitter vehicle is given. The transmitter spectrum signature data obtained with a resistive load was converted to field strength and fitted with a linear regression line on log–log coordinates. This regression line is compared with the regression line obtained from the radiated field strength data of the vehicle mounted transmitters. Author

N64-22828 Federal Aviation Agency, Washington, D.C.
ANALYSES OF AIRBORNE RADIO FREQUENCY INTERFERENCE (RFI) PROBLEMS
R. E. Haydon, T. F. Barone, L. J. Grady, and T. E. Selby (HRB-Singer, Inc., State College, Pa.) *In* IIT Res. Inst. Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 358–367 (See N64-22809 16-09)

An analysis of radiofrequency interference (RFI) in the nation's air navigational system was conducted for FAA. Three frequency bands were carefully studied: 108 mc to 140 mc, 328 mc to 336 mc, and 960 mc to 1,215 mc. They are used for VOR, Localizer, Communications, Glide Slope, TACAN, DME, and Beacon, respectively. Investigation of actual interference reports and laboratory tests of interference susceptibility of on-board navigation equipment were used to supplement the study. A system to detect, measure, identify, and locate interference sources was recommended for use in the existing FAA flight inspection program. The nature of the FAA program and the desired operational requirements for the system indicated consideration of five major problem areas: interference recognition, transmitter location finding, handoff between operations, aircraft operational problems, and determination of operator responsibility for the RFI system. Author

N64-22829 Georgia Inst. of Tech., Altlanta Engineering Experiment Station
MUTUAL GAIN OF RADAR SEARCH ANTENNAS
R.C. Johnson *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 368–380 refs (See N64-22809 16-09)
(Contract NObsr-85387)

Experimental data indicate that the gain characteristics of radar search antennas can be described by gaussian curves; further, mutual gain measurements with pairs of antennas indicate that the mutual gain characteristics can be described by a gaussian curve having a median gain equal to the sum of the median gains of the individual antennas and a standard deviation equal to the square root of the sum of the squares of the individual standard deviations. Modifications of an AN/SPS-10 antenna resulted in significant improvements in the radiation characteristics. The median gain was reduced 10 db with no degradation of the main lobe. A brief evaluation of two modified antennas aboard two destroyers at sea indicated that about a 20-db increase in isolation between the two SPS-10 radars was achieved, as predicted. Author

N64-22830 IIT Research Inst., Annapolis, Md. Electromagnetic Compatibility Analysis Center
PROBABILITY OF INTERFERENCE FROM RANDOMLY DISPERSED SOURCES
P. F. Christopher *In its* Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 381–402 refs (See N64-22809 16–09)
(Contract AF 19(604)-8440)

An approximate (but general) two dimensional probability density function is illustrated for randomly located interference sources. The cumulative distribution is derived for interference strength greater than that required for receiver failure. Original portions of the analysis include a general propagation loss power law, and a general standard deviation of interference strength due to fixed sources. The results represent probability of receiver failure for a fixed desired signal source and interferers dispersed with uniform probability density. They are useful when the variance of interference power is much greater than the variance of desired signal. The maximum density of interference sources per square mile is then found as a function of allowable probability of failure. Author

N64-22831 Army Electronic Proving Ground, Fort Huachuca, Ariz.
ANALYSIS AND EVALUATION OF ELECTROMAGNETIC COMPATIBILITY TESTS
William B. Mc Intosh and George D. Brosious *In* IIT Res. Inst., Ninth Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 403–431 refs (See N64-22809 16–09)

The term electromagnetic compatibility test is first defined and then used in development of the subject. A brief description of the test facility is given, including a description of its two complementary subdivisions: a computer-based interference prediction model and a field facility. The present concept of testing requires that the model be validated against the field facility for each problem and then be used to solve problems under conditions of deployment, terrain, vegetation, and

the like, which cannot be duplicated in the field facility. The status of model validation is discussed, with emphasis on the statistical methods used in the analysis. Application of a validation analysis to a model use problem is considered with reference to the qualifications that must be placed on conclusions drawn from model results. Author

N64-22832 General Electric Co., Palo Alto, Calif.
A WIDE STOP-BAND FILTER FOR A HIGH POWER S-BAND RADAR
J. P. Rooney and F. P. Ventolieri (RADC) *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 432–444 refs (See N64-22809 16-09)
(Contract AF 30(635)-28622-62-5)

The AN/FPS-6 is a high-power S-band radar that emits high levels of spurious power at microwave frequencies. These emissions have, on occasion, hindered its application in areas of high radar and communication link density. The spurious outputs occur at harmonic frequencies and at frequencies just above and below the operating band. As a result, interference with serveral systems at the same time is possible. The solution to this problem is a filter system capable of suppressing all of these outputs. The filter system described is the first to suppress all of the significant spurious microwave power. It consists of five filter components of three different types. The choice of filter types to provide sufficient stop-band attenuation is described. The influence of environment, peak power requirements, and available space on the filter system design is shown. Author

N64-22833 Boeing Co., Seattle, Wash.
A TECHNIQUE FOR DETERMINATION OF FILTER INSERTION LOSS AS A FUNCTION OF ARBITRARY GENERATOR AND LOAD IMPEDANCE
S. M. Vakil *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 445–458 refs (See N64-22809 16-09)
(Contract AT 04(647)-289)

Insertion loss is derived in terms of generator impedance, load impedance, and filter open-circuit and short-circuit impedances. This expression contains a difference term that places great weight on the accuracy with which the filter's impedances are measured. It is shown that the use of this difference term can be avoided by introducing the filter's insertion loss in a circuit with known generator and load impedances. The resulting exact expression contains terms that are easily measurable with sufficient accuracy to provide reliable insertion loss values for the filter for any combination of generator and load impedances. Also shown is a simplified approximate expression for insertion loss that is applicable in a filter's attenuation band. A discussion of experimental verification of the expressions is followed by curves showing application of the approximate insertion loss expression to a particular filter. Author

N64-22834 IIT Research Inst., Annapolis, Md. Electromagnetic Compatibility Analysis Center
ECAC MSS-2 INTERFERENCE PREDICTION PROGRAM — GENERAL
J. A. Zoellner *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 459–468 refs (See N64-22809 16-09)
(Contract AF 18(604)-8440)

The MSS-2 sytem was designed to take as direct input selected portions of the environment file and spectrum signature files now being accumulated. The objective in the design of this scientific data processing system is to automatically enable the complete reconstitution of any specified environmental area. Following this the system injects into the computer the spectrum signature data required, in order that an expandable computer library of mathematical models simulating emission, response, antenna, and propagation effects can be brought to bear to yield interference predictions. The immediate level of planned computer automation design is, given the specification of a problem environment, to obtain a complete interference prediction in 1 to 3 days depending upon complexity. Author

N64-22835 IIT Research Inst., Annapolis, Md. Electromagnetic Compatibility Analysis Center
ECAC MSS-2 INTERFERENCE PREDICTION PROGRAM—CULL MODEL
J. B. Scott *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 469–492 refs (See N64-22809 16-09)
(Contract AF 19(604)-8440)

The ECAC MSS-2 system is a collection of computer automated mathematical models designed to provide quick reaction time solutions to electromagnetic compatibility problems. The designed structure of the MSS-2 system is such that as knowledge is gained in the area of compatibility analysis, the additional knowledge can be reflected readily in additions to the automatic system. Implicit in the design of the Cull Model are several features that are unique in the realm of compatibility analysis. One of these features is the ability to directly use the broad data base that is being established at the ECAC. Contained in this paper is a generic picture of the first operational version of the MSS-2 interference prediction system. Special emphasis in the discussion is placed on the unique features of the system. Use of the model is illustrated. Author

N64-22837 IIT Research Inst., Annapolis, Md. Electromagnetic Compatibility Analysis Center
A PROPAGATION MODEL FOR ELECTROMAGNETIC COMPATIBILITY ANALYSIS
W. E. Frazier and D. S. Anderson *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 505–533 refs (See N64-22809 16-09)
(Contract AF 19(604)-8440)

This paper discusses an automatic propagation computation routine or model for both horizontally and vertically polarized tropospheric wave transmission. Input parameters for the model include effective antenna heights, path surface parameters, and atmospheric refractivity. The various modes of propagation included in the model are discussed. The techniques employed in the mode selection, which are based on frequency and path geometry, are also explained. Some computer results and an engineering flow diagram are presented. Author

N64-22838 IIT Research Inst., Annapolis, Md. Electromagnetic Compatibility Analysis Center
SPECTRUM SIGNATURE SYNTHESIS FOR COMPATIBILITY ANALYSIS
R. W. Fleck, F. C. Pethel, and J. W. Marini *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 534–559 refs (See N64-22809 16-09)
(Contract AF 19(604)-8440)

This paper discusses the basic procedures for obtaining spectrum signatures, the advantages and disadvantages of each method, and the particular features of the method selected. The method for determining spurious responses in single- and double-conversion receivers is discussed. Plots of synthesized receiver responses are compared to measured

response data and the problem areas discussed. The synthesis of the gain characteristics of antennas is discussed with the special emphasis on high-gain reflector-type antennas. The pattern of the antenna is divided into a number of sectors, and the gain statistics of each sector are predicted theoretically or by means of regression techniques using empirical data. Author

N64-22839 Naval Civil Engineering Lab., Port Hueneme, Calif.
THE APPLICATION OF ABSORPTION AND SCATTERING COEFFICIENTS FOR CONCENTRIC SPHERES TO THE PROBLEM OF EMI-FREE ENCLOSURES
R. A. Eldred, H. A. Lasitter, and J. Roberts *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 560–596 refs (See N64-22809 16-09)

With the purpose of increasing the information about the lower frequency shielding effectiveness of closed structures composed of various arbitrary materials, an idealized problem is considered of the scattering and absorption of a plane electromagnetic wave impinging on a spherical shell. The region between the outer and inner radius of the sphere contains an arbitrary material; the other two regions are free space. The absorption and scattering coefficients for the incident plane wave are expressed as an infinite sum of spherical waves, using spherical Bessel functions. The coefficients are calculated numerically and shown for a large range of complex material parameters and frequencies from 100 kc to 1,000 mc. Author

N64-22840 Boeing Co., Seattle, Wash.
SHIELDING THEORY AND PRACTICE
R. B. Shulz, V. C. Plantz, and D. R. Brush *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 597–636 refs (See N64-22809 16-09)
(Contract DA-36-039-AMC-02308)

A plane-wave shielding theory is developed and discussed for a number of important cases such as single, double, and laminated shields. For application to design, the basic expressions are modified and plotted with universal parameters for convenient use in performance calculations of both solid and perforated sheets. Performance of solid copper and iron shields were calculated and are presented in both tabular and graphical form. For these and other materials, measurement results of various experimenters are tabulated for a number of different material forms and for various incident-wave impedances. Some consideration is given to shielding discontinuities and trends in modern shielding enclosures. Author

N64-22841 General Dynamics/Astronautics, San Diego, Calif.
SHIELDING A FLIGHT VEHICLE AGAINST ELECTROMAGNETIC INTERFERENCE DURING TEST
R. O. Lange *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 637–655 refs (See N64-22809 16-09)

This paper discusses the construction of a 40-ft × 40-ft × 20-ft high shielded anechoic facility, its evaluation, the method of physically supporting the vehicle during test, and use of the test chamber in a program of electromagnetic interference elimination on the Centaur space vehicle. The frequency range of interest is 200 mc through 6 Gc. The discussion of construction covers principally the design of the facility and the solution of problems involved in maintaining the integrity of the metal shielding subsequent to providing the required apertures. Evaluation includes the results of tests made during various stages of construction and upon completion of alterations. Use of the chamber includes the purposes for which the facility was built and its present and anticipated usefulness. Author

N64-22842 Naval Research Lab., Washington, D.C.
PROPAGATION IN ABSORBENT-MATERIAL-LINED CAVITIES
J. W. Wright and W. E. White *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 656–667 ref (See N64-22809 16-09)

Attempts to analyze microwave darkrooms in terms of free space transmission concepts are often unsuccessful. Experimental results are given for several darkroom models with various types of absorbent material, which illustrate the nature of the problem. A waveguide-type mode can propagate with little attenuation. In fact, the better the absorbent material lining the tunnel, the lower the attenuation. Phase and amplitude measurements on such modes and information on how they are excited are presented in detail. The effect of these and other modes of propagation on the performance and evaluation of microwave darkrooms is discussed. Author

N64-22843 Hewlett-Packard Co., Palo Alto, Calif. Microwave Lab.
A SPECTRUM ANALYZER WITH 2 GC DISPLAY
A. Fong, H. L. Halverson, E. C. Jung, and R. W. Anderson *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 668–680 refs (See N64-22809 16-09)

Frequency spectra up to 2-Gc wide can be displayed in a spectrum analyzer using a 2-Gc IF amplifier and 2 to 4-Gc backward wave local oscillator. For displays 10-mc to 2-Gc wide, the stability of the BWO is sufficient to allow use of resolutions 10 kc to 1 mc. For much narrower displays of 100 kc to 10 mc where narrower resolution is desired, the BWO can be phase locked to a harmonic of a very stable low-frequency reference oscillator. Frequency spectra within the range of 10 mc to 40 Gc can be analyzed. Author

N64-22844 IIT Research Inst., Chicago, Ill.
INTERFERENCE SPECTRUM ANALYZER WITH AUTOMATIC FREQUENCY SCANNING AND DATA RECORDING
L. Valcik, J. E. Batz, J. N. Faraone, and D. Rees (AFSC) *In its* Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 681–700 (See N64-22809 16-09)
(Contract AF 33(616)-8428)

A broadband electronically tuned spectrum analyzer for pulsed interference signals was developed. Sweeping at the uniform rate of 500 mc each second the unit scans portions of the UHF and SHF bands in approximately 1/2 min. With a receiver bandwidth of 10 mc, data are read out and recorded every 20 msec, corresponding to a 10 mc-frequency increment. For each 10-mc frequency increment, individual incoming pulses are first quantized on an amplitude basis, with seven amplitude bins each about 12-db apart. Next, for each amplitude bin the pulses are counted, and the pulse count is quantized into seven bins. Data are expressed in terms of three-digit binary numbers that are recorded on three tracks of magnetic tape. The analyzer repetitively scans the four microwave bands until the entire 4-hour tape-recording capacity has been utilized, at which time the unit turns itself off. For data readout the recording tape is played back at a high rate into auxiliary equipment that converts the data to a standard IBM format on another tape. This new tape is then used with the IBM 1401, the IBM 7090, and a suitable program for decoding

the recorded data and obtaining a data print out. Data are sorted by frequency, with the result of each successive sweep listed sequentially. The chronological changes in signal environment over the 4-hour period for each 10-mc increment are thus available. Author

N64-22845 Polarad Electronics Corp., Long Island City, N.Y.
MEASUREMENTS TECHNIQUES WITH A SPECTRUM SIGNATURE MONITOR
M. Feigenbaum and R. Sandstrom *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 701–708 ref (See N64-22809 16-09)

This paper describes the use of a spectrum signature monitor in conjunction with a field intensity receiver for interference measurements. Its use speeds measurements and provides for rapid identification of modulated signals. The greater resolving capabilities due to its narrow bandwidth allow for the measurement of low-level spurious signals close to the desired signal. Author

N64-22846 McDonnell Aircraft Corp., St. Louis, Mo. Aircraft Systems Eng. Div.
ELECTROMAGNETIC COMPATIBILITY PROGRAM FOR THE MC DONNELL RF-4C, PHANTOM II AIRCRAFT
W. D. Mc Kerchar *In* IIT Res. Inst. Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 709–724 (See N64-22809 16-09)
(Contract NOW-62-0383-I)

The RF-4C aircraft involves a high density installation of electronic, electrical, and electrooptical subsystems, integrated to perform a tactical reconnaissance mission. Successful integration of individual subsystems in aircraft weapon systems depends significantly on the effects of interconnecting wiring and the associated grounding techniques. Inter-cable and intracable crosstalk among power, control and signal circuits may be high. Irradiation of cables by high power CW and pulsed energy, and the resulting high level coupling may cause serious data degradation and system malfunction, and may also pose the threat of premature ignition of on-board ordnance devices. Author

N64-22847 Westinghouse Electric Corp., Baltimore, Md. Air Arm Div.
A METHOD FOR PERFORMING TRANSIENT SUSCEPTIBILITY TESTS ON PRIMARY POWER LEADS
R. F. Kantner *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 725–735 (See N64-22809 16-09)

This paper describes a method for performing audiofrequency susceptibility tests on primary power leads using square waves, triangular shaped pulses, exponentials, and most other types of functions. On d.c. power leads this can be accomplished using well-known methods such as transformer coupling and series modulators. To vary the rms voltage on a.c. power leads in some functional manner, use is made of the result that occurs when an a.c. signal at a frequency close to or at the power line frequency is transformer coupled onto the power line. Author

N64-22848 Northrop Corp., Hawthorne, Calif. Nortronics Div.
MIL-E-6051 ELECTROMAGNETIC COMPATIBILITY TESTING CONCEPTS AND TECHNIQUES
W. A. Taylor *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 736–746 (See N64-22809 16-09)

This paper discusses MIL-E-6051 electromagnetic compatibility testing concepts and instrumentation techniques necessary to implement the tests. For compatibility tests to be realistic, the test procedures and implementing instrumentation must be designed to complement and be compatible with both the test specimen system and data requirements of the test program. Procedures and monitoring equipment must permit the system to be operated as an integrated system through an operational sequence that faithfully reflects the intended tactical operation. Author

N64-22849 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
ANALYSIS OF THE HIGH IMPEDANCE FIELD IN SUSCEPTIBILITY TESTS
W. A. Stirrat *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 747–774 ref (See N64-22809 16-09)

The susceptibility test requires that equipment be immersed in strong, vertically polarized, high-impedance 14-kc to 20-mc fields; this introduces difficulties, for the most part solved by minimizing the space Y between the driven vertical monopole antenna of height H and the item of height Z under test. If at Y the field is 6 db lower at Z above ground than at ground, then the minimum Y is $Z/\sqrt{3}$ for $H/Z > 5.5$, is $8Z/3$ for $H/Z < 1.2$, and approximately $3.2Z^2/H$ for $1.2 < H/Z < 5.5$. For fields at ground level, curves of the monopole driving voltage requiring 1v/m, and the width over which the field will fall off 6 db, are plotted vs Y for specific monopoles; the theory is developed. Also discussed are experimental verification, impedance matching transformers for the monopole, mutual impedance considerations, and application to receiving antennas. Author

N64-22850 Westinghouse Electric Corp., Pittsburgh, Pa.
RADIO NOISE CONSIDERATIONS FOR EXTRA HIGH VOLTAGE TRANSMISSION, 345 TO 1000 KILOVOLTS
E. R. Taylor and W. E. Pakala *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 775–785 refs (See N64-22809 16-09)

This paper discusses several aspects of radio noise from extra-high voltage (EHV) transmission lines. Specifically, it discusses radio noise generation and the effects of weather, the principal type of radio noise meter detector used for measurements, the relations of the line radio noise measurements to the AM broadcast station signal levels, the methods of making measurements in the field and the effect of various transmission line parameters on the radio noise field strength in the vicinity of the line. The possible sources of radio noise generation are discussed, and the need for measurements on existing lines and short test lines to make predictions for new and higher voltage lines is also discussed. Author

N64-22899 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J. Army Electronics Research and Development Lab.
PULSED NUCLEAR RADIATION INDUCED TRANSIENTS IN ELECTRONIC PARTS AND MATERIALS (GODIVA IV & V)
H. J. Degenhart, W. Schlosser, and H. Bruemmer Jan. 1963 60 p refs
(USAELRDL-TR-2299; AD-409579)

The electronic parts investigated and monitored during

exposure include coaxial cables, resistors, capacitors, rectifiers, and magnetic cores of various types, values, and materials. Most of the parts during exposure show transient parameter changes that exceed the tolerance values and then generally recover to their nominal values some time after completion of the radiation pulse. Some of the data show inconsistencies. In some cases, e.g., low- and high-value resistors, NiCr thin-film resistors of various values, and ceramic capacitors, the data show certain repetitive patterns in the behavior of these parts. Author

N64-22914 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
INTERATIVE PARAMETRIC AMPLIFICATION WITH SEMICONDUCTOR REACTANCE DIODES
Peter Bobisch and Claus Sondhauss 24 Mar. 1964 22 p refs Transl. into ENGLISH from Die Telefunken Röhre, no. 42, 1963 p 125–144
(RSIC-146; AD-436201)

This paper discusses a new type of parametric amplifier composed of essentially four reactance diodes connected in a ring-circuit manner. This system can be used for iterative traveling-wave parametric amplification along three transmission-lines coupled by diode quartets. Author

N64-22955 Ohio State U. Research Foundation, Columbus Antenna Lab.
ELECTRONIC BEAM-CONTROL OF DIPOLE ARRAYS USING INTEGRATED ANTENNA-CIRCUIT DESIGN
R. G. Verstraete 1 May 1964 76 p refs
(Contract AF 33(657)-10386)
(Rept.-1566-10; AD-440968)

This report deals with the following: (1) the general relationship between pattern and array source distribution and the determination of the required excitation to obtain a predescribed pattern; (2) an explanation of the concept of integrated design and its advantages and applications; (3) a description and analysis of a transistorized dipole antennafier—the basic element in integrated dipole array design; (4) the experimental results obtained with an array of transistorized dipole antennafiers; (5) the problem of electronically controllable phase shifters; and (6) completely integrated amplitude and phase control. I.v.L.

N64-22976 Arizona U., Tucson Argonne National Lab., Ill.
A SYMPOSIUM ON HIGH TEMPERATURE CONVERSION — HEAT TO ELECTRICITY
Earl W. Phelan, ed. (Argonne Natl. Lab.) [1964] 420 p refs Symp. Held at Tucson, 19–21 Feb. 1964 in Cooperation with Argonne Natl. Lab.
(Supported by AEC)
(TID-7687)

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20. FUELED DOUBLE MODULE CONVERTERS: FABRICATION, TESTING AND EVALUATION J. E. Monroe, Jr. (Martin Co.) and D. W. Stoffel p 360–383 refs (See N64-22995 16-09)

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N64-22977 Atomic Energy Commission, Washington, D.C.
PROBLEMS AND PROGRESS IN THERMIONICS
J. M. Prosser *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 10–20 refs (See N64-22976 16-09)

Thermionics is discussed in terms of its history, its progress, and problems in the development of efficient and reliable thermionic converters. Consideration is given to providing power for space vehicles through thermionic converters and to the requirements for realizing this type of space power-supply system. C.L.W.

N64-22978 Radio Corp. of America, Princeton, N.J.
SOME SURFACE PHYSICS CONCEPTS IN THERMIONICS
Jules D. Levine *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 21–26 refs (See N64-22976 16-09)

A review is given of some of the concepts utilizing adsorption phenomena in thermionics. Fundamental principles are stressed rather than maximum power densities, efficiencies, and hardware aspects. The review is separated into two parts, one part covering substrate concepts and the other part covering adsorbate concepts. C.L.W.

N64-22979 Argonne National Lab., Ill.
THE DEVELOPMENT OF NUCLEAR THERMIONIC MATERIALS
James F. Schumar *In* Ariz. U. A Symp. on High Temp. Conversion—Heat To Elec. [1964] p 27–44 refs (See N64-22976 16-09)

This report covers high-temperature properties of high-melting-point nuclear materials for use in thermionic systems. Two systems for incorporating nuclear fuel in the emitter of a thermionic diode are investigated: bare emitters and clad emitters. The study of bare emitters includes vaporization studies of uranium carbide–zirconium carbide systems and of their vacuum emission properties. The vaporization studies take into consideration the influence of composition, time, temperature, and cesium vapor on the weight loss of the mixed carbides. In the study of clad emitters, emphasis is placed on the compatibility of the nuclear fuel materials with the emitter materials. C.L.W.

N64-22980 General Motors Corp., Detroit, Mich. Research Labs.
NOBLE GAS PLASMAS AND EMITTER MATERIALS FOR NUCLEAR THERMIONIC CONVERTERS
Frank E. Jamerson *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 45–50 refs (See N64-22976 16-09)

Studies of noble-gas plasmas and emitter materials for application to a nuclear thermionic converter are outlined. The plasma is generated by fission fragment ionization of the gas. Ionization tubes operated in a high neutron flux indicate that an ion source of 10^{16} ions sec^{-1} cm^{-3} can be generated with a gas pressure of 240 torr. Two classes of emitter materials, a high-temperature UC-Re cermet and a low-temperature $BaO\text{-}UO_2$-W cermet, have been developed for noble-gas diode application. The low-temperature cermet provides current densities in vacuum of 7.2 amp/cm^2 at 1,200° C.
Author

N64-22981 Arizona U., Tucson
ELECTRICAL PROPERTIES OF Al_2O_3 AT HIGH TEMPERATURE IN HIGH RADIATION FIELDS
G. J. Dav and M. V. Davis *In its* A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 51–57 refs (See N64-22976 16-09)

This article concerns the determination of the operational limits of ceramic oxide insulators for incorporation into in-core thermionic diode design. Alumina was chosen as the specific ceramic oxide, and a method is given for determining its electrical resistivity at high temperatures and in radiation fields. From measurements of the electrical resistivity and examination of the data it is concluded that the effects of radiation and temperature are important in designing electrical insulators for in-core operation. C.L.W.

N64-22982 Texas Instruments, Inc., Dallas
LOW WORK FUNCTION COLLECTORS FOR THERMIONIC ENERGY CONVERTERS
R. A. Chapman *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 58–73 refs (See N64-22976 16-09)
(Sponsored in Part by ONR)

This article discusses thermionic energy converters and, in particular, the role of the collector electrode in power output and efficiency, the available collector materials, and a compatible converter design for these materials. Several ways are given for reducing the work function of the collector and for constructing a thermionic converter incorporating these collectors. C.L.W.

N64-22983 Martin Co., Baltimore, Md. Nuclear Div.
DOUBLE-DIODE THERMION, C ENERGY CONVERTER
J. D. Long, J. Psarouthakis, and E. Scicchitano *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 74–91 (See N64-22976 16-09)
(Contract AF 33(657)-10077)

Results of an extensive research and development program were used to evolve the design of a double-diode thermionic module for out-of-pile testing. Three double-diode thermionic converters, each consisting of two diodes of cylindrical configuration connected electrically in series within a single sheath and using a common cesium reservoir, have been fabricated and tested to evaluate design criteria of a multidiode converter element. Two of these double diodes were built with emitters consisting of a uranium dioxide–molybdenum cermet clad with molybdenum–1/2% titanium, and provisions were made for electrical heating. These two modules were tested for periods of 330 and 715 hr, respectively, at emitter temperatures between 1,500° and 2,000° C. The third double-diode, unfueled, but of similar geometry and with a solid molybdenum–1/2% titanium emitter, has accumulated over 2,000 hr of life tests at emitter temperatures between 1,500° and 2,100° C.
Author

N64-22984 Los Alamos Scientific Lab., N. Mex.
THE DEVELOPMENT OF FISSION HEATED THERMIONIC CONVERTERS
William A. Ranken *In* Ariz. U. A Symp. on High Temp. Conversion—Heat To Elec. [1964] p 92–116 refs (See N64-22976 16-09)

An argument is given for the most effective methods of testing fission-heated thermionic converters. The discussion covers both the advantages and disadvantages of studying converter physics in the reactor and under laboratory conditions. C.L.W.

N64-22986 Los Alamos Scientific Lab., N. Mex.
EXPERIMENTAL OBSERVATIONS WITH A CESIUM PLASMA CELL WHICH HAS A URANIUM CARBIDE EMITTER
Walter H. Reichelt *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 132–160 refs (See N64-22976 16-09)

An experimental investigation was conducted on a cesium plasma planar diode that had a uranium carbide emitter surface. The investigation included the determination of the effects of

cesium pressure on the cell operating characteristics, the power density determinations for various cell conditions, the spectroscopic determinations of electron temperatures, and ion densities across the interelectrode gap. C.L.W.

N64-22987 Arizona U., Tucson
DC AND HIGH FREQUENCY VOLTAGE AND POWER OUTPUT AND INTERACTION IN CESIUM, POTASSIUM AND SODIUM THERMIONIC CONVERTERS
Hans Kohn Richards *In its* A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 161–199 refs (See N64-22976 16-09)

A plasma diode with a tantalum emitter and a molybdenum collector and guard ring was operated with cesium, potassium, and sodium vapor. The emitter–collector distance, vapor pressure, and emitter temperature were varied during the experiments. An inductance capacitance network separated the d.c. output from the high-frequency RF component and permitted the study of d.c. and RF interaction for d.c. and RF voltage, current, and power output. It was found that the cesium and potassium cells performed similarly. The maximum d.c. voltage for cesium measured at the knee of the characteristic curves is only 0.1 or 0.2 volt higher than for potassium. The sodium cell did not operate very well at pressures less than 10^{-3}-mm Hg, as could be expected, since its ionization voltage exceeds the work function of the tantalum emitter and contact ionization should be less than 1% of cesium ionization. Author

N64-22989 Thermo Electron Engineering Corp., Waltham, Mass.
CORRELATION OF INTERNAL VOLTAGE LOSS IN OPTIMIZED THERMIONIC CONVERTERS
Sotiris Kitrilakis *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 214–219 (See N64-22976 16-09)
(Supported by ONR)

Families of current–voltage curves are given in presenting performance data for thermionic converters. These curves were taken with fixed emitter and collector temperatures and interelectrode spacing and with variable cesium reservoir temperatures. The individual current–voltage curves cross each other, and for any given voltage one particular curve exhibits maximum current. C.L.W.

N64-22990 General Motors Corp., Indianapolis, Ind. Allison Div.
EXPERIMENTAL INVESTIGATION OF A CAVITY EMITTER
J. D. Dunlop *In* Ariz. U. A Symp. on High Temp. Conversion—Heat To Elec. [1964] p 220–246 refs. (See N64-22976 16-09)

The results of an experimental investigation of a cavity emitter are presented. The cavity emitter concept evolved from a study of a capillary emitter; therefore, a brief review of the capillary emitter is presented. To verify the cavity emitter concept, a slotted emitter was conceived and fabricated. The experimental results from this converter are presented and compared to the theoretical expectations. The plasma properties of the capillary converter described were investigated using spectroscopic techniques. The results of this investigation are presented and include measurements of electron temperatures and densities in the plasma. Author

N64-22991 Martin Co., Baltimore, Md.
BARIUM VAPOR-FILLED THERMIONIC ENERGY CONVERTERS
A. J. Kennedy and P. K. Shefsiek *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 247–293 refs (See N64-22976 16-09)
(Contract AT(30-1)-2933)

Experimental data are given for plasma thermionic energy converters in which barium, rather than cesium, is used as the vapor material. Barium adsorption on refractory metal emitters, in the temperature range of 1,800° to 2,000° K, is such that current densities of 1 to 10 amp/cm^2 are obtained at vapor pressures of less than 0.1-mm Hg. Consequently, power losses due to collision in the interelectrode gap are quite small, and performance shows little dependence on interelectrode spacings, even for spacings as large as 0.020 to 0.050 inch. Performance of the barium vapor-filled converter is also marked by an ability to use a high collector temperature; output power densities in the range of watts/cm^2 maximize at collector temperatures in excess of 1,200° K. Also of interest are anomalous effects near the knee of the charactersitic curves, which occur at intermediate interelectrode spacings. Author

N64-22992* Thermo Electron Engineering Corp., Waltham, Mass.
SOLAR ENERGY THERMIONIC (SET) CONVERTER DESIGN HISTORY
Pierre J. Brosens *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 294–320 refs (See N64-22976 16-09)
(Contract NAS7-100; JPL-950228)

This paper aims at presenting an overall view of thermionic converter design effort and its most important results. It is addressed both to the technical community engaged in the development of thermionic hardware and to those interested in evaluating the suitability of such hardware for practical applications, such as the conversion of solar energy in space. Author

N64-22993 United Aircraft Corp., East Hartford, Conn. Research Labs.
SPECTROSCOPIC OBSERVATIONS OF AN ARC-MODE CESIUM THERMIONIC CONVERTER
J. E. Rizzo and D. W. Bell *In* Ariz. U. A Symp. on High Temp. Conversion–Heat to Elec. [1964] p 321–343 (See N64-22976 16-09)

Spectral observations were made of the arc-mode operation of a cesium-filled thermionic converter using an f/4 grating spectrograph with photographic plates as a recording medium. A band spectra of molecular cesium is observed in emission, with an intensity structure significantly different from that reported from absorption work. The emission bands adjacent to the primary atomic resonance line of cesium are the dominant band structure and appear to be excited directly by the trapped photons of the atomic resonance transition. The intensity and distribution of the molecular radiation indicate the presence of a significant number of excited cesium molecules, which tends to support recent postulations that molecular processes may be responsible for a large part of the ionization necessary to the maintenance of the thermionic arc-mode. In addition to the molecular band spectra and the normal atomic lines of cesium, six atomic lines are observed that appear to be associated with forbidden transitions. The intensity behavior of the normal and forbidden atomic lines and the molecular bands differed from each other under various converter operating conditions and positions within the interelectrode spacing. Author

N64-22994 Atomics International, Canoga Park, Calif.
THERMIONIC BACK-PACK POWER SUPPLIES

W. R. Martini *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 344–359 refs (See N64-22976 16-09)
(Contract DA-36-039-SC-88982)

Three possible design configurations are presented for a flame heated thermionic converter, and the problems that must be solved before these converters can be applied to a thermionic back-pack power supply are discussed. These problems are as follows: (1) protection of the vacuum envelope from oxidation and gas permeation; (2) efficient and reliable diode heating; (3) construction of flame-heated diodes with long life at a high power density and a high efficiency; (4) temperature control of the cesium reservoir; (5) air and fuel supply and regulation; (6) electrical conversion; and (7) package integration. C.L.W.

N64-22995 Martin Co., Baltimore, Md. Nuclear Div.
FUELED DOUBLE MODULE CONVERTERS: FABRICATION, TESTING AND EVALUATION
James E. Monroe, Jr., and D. W. Stoffel *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 360–383 refs (See N64-22976 16-09)
(Contract AF 33(657)-10077)

A fueled double-diode thermionic module for out-of-pile testing was designed. Two modules, each consisting of two diodes of cylindrical configuration connected electrically in series within a single sheath and utilizing a common cesium reservoir, were fabricated and tested. The emitters were molybdenum-clad uranium dioxide–molybdenum cermet bushings, which were used to simulate nuclear fuel in the module. The two modules were tested for cumulative periods of 330 and 715 hours, respectively, at emitter temperatures between 1,500° and 2,000° C, and at an emitter–collector spacing of 17 to 18 mils. Output power densities of 1.5 to 6.0 watts/cm^2 were produced under these conditions. Upon completion of the testing, each of the modules was disassembled and examined. Detailed findings are reported. Author

N64-22996 General Electric Co., Pleasanton, Calif. Vallecitos Atomic Lab.
IN-REACTOR TESTING OF NUCLEAR THERMIONIC CONVERTERS
Herman Miller *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 384–408 (See N64-22976 16-09)

In-pile research on thermionic conversion systems is described that is directed toward the development of a nuclear thermionic fuel element for a space power reactor. The discussion reviews briefly the design fabrication and testing of these thermionic converters, describes the testing techniques, notes the problems, and presents some of the most recent results. C.L.W.

N64-23027* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESIGNING TOROIDAL INDUCTORS WITH DC BIAS
G. D. Smith Washington, NASA, Jun. 1964 13p
(NASA-TN-D-2320) OTS: $0.50

A practical method of designing toroidal inductors with d.c. bias is presented. The toroidal core equations for the inductance, magnetizing force, and core winding factor are used to derive two equations for selecting the smallest possible core. Acceptable requirements are established for the variation of Q with frequency and for the variation of inductance with temperature. The inductor equations and requirements indicate the desirable combinations of core constants and from these the smallest core may be determined. A step-by-step procedure for establishing the inductor requirements, selecting the smallest core, and designing the inductor is given, explained, and illustrated. Tables and curves empoyed in this method of design are presented. Author

N64-23041* National Aeronautics and Space Administration. Washington, D.C.
A MINIATURE WIDE-BAND ELECTROMETRIC AMPLIFIER [MALOGABARITNYY SHIROKOPOLOSNYY ELEKTROMETRICHESKIY USILITEL']
M. Ye. Slutskiy, B. I. Zarkhin, and M. A. Pushkina Feb. 1964 11 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, Sep.–Oct. 1963 p 296–302
(NASA-TT-F-8822)

A description is given of a d.c. amplifier with an input impedance of 10^{12} ohms and a small time constant of the order of 10^{-2} sec. The amplifier has one tube—the electrometric pentode type I-1—all other stages are transistorized. The circuit provides high null stability and low noise level when powered by a nonstabilized source of direct voltage of 14 ± 2 v. The small dimensions and high mechanical strength of the construction make this amplifier suitable for use in various types of equipment installed aboard research rockets and artificial earth satellites. Author

N64-23081 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE INVARIANCE OF PULSED AUTOMATIC CONTROL SYSTEMS
L. Z. Grishchenko and D. F. Boldireva *In its* Automation 14 Feb. 1963 refs p 1–10 (See N64-23080 16-17)

Conditions of invariance in a closed pulsed system of control are studied with respect to outer disturbances. Differential equations are introduced for a system of discrete control that works on the principle of deviation of the controlled system. It is assumed that the pulsed element transforms the input value that changes continuously in a sequence of equally spaced pulses, proportional to the input value at a discrete moment of time. Equations for the control object, the measuring device, the pulse element, and the operational mechanism are integrated, and the obtained differential equations are operated algebraically to obtain the general conditions of invariance. M.P.G.

N64-23082 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STABLE AND DYNAMIC CONDITIONS OF OPERATION OF AN EXTREMAL SYSTEM FOR CONTROLLING A HYDROMONITOR, PART II
B. Yu. Mandrovskiy-Sokolov *In its* Automation 14 Feb. 1963 refs p 11–26 (See N64-23080 16-17)

A step-by-step extremal system with two controlling effects is discussed. The object of control of such a system is described. The task of the extremal system of controlling the hydromonitor is to properly select program elements (arm of repulsing, rate of movement of stream of water after stopping) in order to obtain maximum operational productiveness of the hydromonitor. The magnitude of the repulsing arm changes within certain intervals of time, which are designated by the program, and the rate of flow of the stream of water after stopping can change continuously because the program imposes limitations on the moment of change in control influences. Author

N64-23085 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STATIC CHARACTERISTICS OF AC THROTTLE DRIVES

Yu. M. Rozov *In its* Automation 14 Feb. 1963 refs p 56–67 (See N64-23080 16-17)

The possibilities of improving the static characteristics of an a.c. throttle drive by controlling current and voltage differentials and by using an asynchronous motor rotor are established. The investigations show that static error due to change in load moment can be reduced practically to zero by connection of an artificial nonlinearity into the feedback circuit for the current. M.P.G.

N64-23086 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

TRI-PHASE REVERSE DRIVE WITH MAGNETIC SEMICONDUCTOR AMPLIFIER

N. V. Khrushchova *In its* Automation 14 Feb. 1963 refs p 68–73 (See N64-23080 16-17)

The circuit is described of a triphase, reversible, asynchronous, throttle drive without electron tubes and with stabilizing feedback for speed control without a tachometer generator. The first phase-sensitive amplifier is based on P4-A triodes, and the second and third are magnetic amplifiers. The third power-amplification stage consists of five or six magnetic amplifiers for direct and reverse rotation of the motor. Rate of rotation stabilization is attained by positive feedback for current and negative feedback for voltage. M.P.G.

N64-23090 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

AUTOMATIC POTENTIAL (VOLTAGE) REGULATOR TO PROTECT UNDERGROUND INSTALLATIONS AGAINST CORROSION

I. K. Parra and N. V. Petina *In its* Automation 14 Feb. 1963 refs p 92–95 (See N64-23080 16-17)

A static potential regulator is described that maintains the potential difference at the level required for cathodic protection of underground installations (such as pipelines) from corrosion. The circuit diagram is presented for an automatic cathodic protection station that is contactless, based on magnetic boosters and germanium diodes, and has no rotating parts. Such a system has been successful in actual application, and is particularly recommended for use in areas where stray currents are present. M.P.G.

N64-23095 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

HIGH-STRENGTH CERAMIC MATERIALS FOR HIGH-VOLTAGE INSULATORS

S. M. Rozintsveyg and S. A. Kudrina *In its* Probl. in Develop. of Glass and Porcelain Ind. 28 May 1963 p 12–15 (See N64-23093 16-01)

Five ceramic materials, high-strength porcelain, ascharite, a zirconium ceramic, a corundum ceramic, and mullite, are compared with respect to their bending, rupture, and impact strength, heat resistance, dielectric loss-angle, specific volumetric resistance, breakdown voltage, and optimum temperature of firing. Also the dependence of the mechanical strength of such materials on their quartz content and the amount of porcelain present are demonstrated. D.E.R.

N64-23108 National Co., Inc., Malden, Mass.

MANUFACTURING METHODS, PROCESSES AND DEVELOPMENT FOR CESIUM BEAM FREQUENCY STANDARDS, PHASE II First Iterim Engineering Progress Report, 9 Sep. – 9 Dec. 1963

Saul Fast [1963] 48 p refs
(Contract AF 33(657)-10985)
(IR-7-967 (1); AD-436001)

Data obtained on the electronics, cesium-beam tube, and mechanical design of the cesium-beam frequency standard are presented. Data gathered on individual circuits during tests conducted over specified temperature and voltage ranges are described. Necessary design changes for improved circuit performance are discussed. Each circuit is individually analyzed, and an overall performance prognosis is presented. P.V.E.

N64-23110 General Motors Corp., Kokomo, Ind. Delco Radio Div.

PRODUCTION ENGINEERING MEASURE TO IMPROVE PRODUCTION TECHNIQUES AND INCREASE THE RELIABILITY OF THE 2N1358A TRANSISTOR

J. C. Kuhns [1964] 26 p
(Contract DA-36-039-SC-86725)
(QPR-7; AD-436871)

This report reviews the status of the evaluation programs on three of the process and equipment programs. Favorable results were attained with the unit size crystal growing facilities. Failure rates and graphs of parameter distributions of Milestone V tests are included. The high-temperature storage test results were excellent, bettering the goal in the contract. The high stress operating life test results again showed improvement of both stability and failure rate. The report contains a discussion of the final proof test program and a section about special tests conducted to identify early turnon failures on high-stress operating life tests. Results of the Milestone V failure analysis program are presented. Author

N64-23135 Minneapolis-Honeywell Regulator Co., Hopkins, Minn.

INVESTIGATIONS OF ION AND ELECTRON DRIFT VELOCITIES IN CESIUM Final Report

L. M. Chanin 25 Mar. 1964 22 p refs
(Contract DA-31-124-ARO(D)-11)
(AROD-35882; AD-438207)

Measurements were made of the drift velocities of ions and electrons in cesium vapor. The present report briefly summarizes the main results of the ion measurements. The electron drift velocity technique and the results and conclusions reached regarding the electron drift velocity measurements are discussed. Author

N64-23142 University of Southern Calif., Los Angeles Electronics Personnel Research Group

THE PSYCHOLOGICAL DIMENSIONALITY OF BASIC ELECTRONIC CIRCUITS: II. INTERPRETATION OF THE STATISTICAL DIMENSIONS

Joseph W. Rigney Mar. 1964 73 p refs
(Contract Nonr-228(22))
(TR-39; AD-436453)

Two multidimensional scaling techniques were applied to thirteen basic electronic circuits. One technique was the standard technique, in which Ss judged the proximity of the circuits with one another; the second was a new technique, in which the proximity judgments were restricted to a conceptual-difficulty referent. The dimensional structures of these two sets of data were analyzed and compared. The comparison showed that the two techniques yielded different dimensional structures. In a somewhat novel approach to interpreting these dimensional structures, a factor analysis was performed on the thirteen circuits scaled on ten common circuit characteristics. The first two dimensions obtained from the standard proximity technique (similarity dimensions) were closely related to complexity and waveform factors, respectively; the first two dimensions obtained from the new technique, using conceptual difficulty as a referent (difficulty dimensions), were closely

related to experiential and complexity factors, respectively. Author

N64-23146 France Ministere de L'Air, Paris
STUDY OF AN EXPOSURE METER IN ELECTRON MICROSCOPY [ETUDE D'UN POSEMETRE EN MICROSCOPIE ELECTRONIQUE]
Jean-Pascal Valentin Paris, Serv. de Documentation Sci. et Tech. de L'Armement, (SDIT), Dec. 1963 61 p refs In FRENCH *Its* Publ. Sci. et Tech. no. NT-131
Available from SDIT, 2 Ave. de la Porte-D'Issx, Paris

After an explanation of the reasons for using an exposure meter in electron microscopy, the principle, theory, and fabrication of the device are discussed. In a study of the direct current amplifier it is found that currents collected are of the order of 10^{-8} to 10^{-12} amp; after amplification they are of the order of a milliampere. The laws governing sensitometry of photographic emulsions are reviewed. An experimental method and the results obtained, relative to the outline of the characteristic curves of the electrosensitive layers studied, are given. Trans. by D.E.W.

N64-23149 Argentina Comision Nacional de Energia Atomica, Buenos Aires
PULSE COUNTER [CONTADOR DE PULSOS]
Omar Garcia and Manfredo Kopp Nov. 1963 22 p refs *Its* Informe no. 85 In SPANISH

The monitor counts impulses from Geiger-Mueller tubes. Discussed are source of polarization for the detector tubes, extinction and dead time, impulse integrator, and a 1-minute intervalometer that automatically initiates and concludes each cycle of measurement. Also discussed are the characteristic principles of the monitor, a brief explanation of the theory of the circuits utilized, the errors in measurement, and a few instructions for the operation and maintenance of the apparatus. Trans. by D.E.W.

N64-23212 Oak Ridge National Lab., Tenn. Solid State Div.
PARAMAGNETIC CENTERS IN GERMANIUM DIOXIDE GLASS PRODUCED BY ELECTRON AND GAMMA-RAY IRRADIATION
Terry Purcell (M.S. Thesis—Vanderbilt U.) Jun. 1964 77 p refs
(Contract W-7405-ENG-26)
(ORNL 3635)

Paramagnetic centers produced in germanium dioxide glass by Cesium-137 gamma rays and 1.5 Mev electron irradiations at room temperature were observed by electron spin techniques of approximately 78° K. On the basis of optical properties, the high spin concentration, and the estimated impurity content, it was assumed that this center was intrinsic to the GeO_2 glass. Annealing of the electron irradiation glass produced another center similar to the one observed after irradiation. J.R.C.

N64-23221* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MRIR-PCM TELEMETRY SYSTEM—A PRACTICAL EXAMPLE OF MICROELECTRIC LOGIC DESIGN
Paul M. Feinberg Washington, NASA, Jul. 1964 20 p
(NASA-TN-D-2311) OTS: $0.75

Digital satellite systems containing microelectronic circuitry require the use of unique design techniques. This report describes the logic design for one such unit, the medium resolution infrared–pulse code modulation (MRIR–PCM) telemetry system. In addition, basic microelectronic design techniques are given. Author

N64-23225 Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
METAL FORMING BY CAPACITOR BANK DISCHARGES
Gerald T. Connell Jan. 1964 4 p refs
(RN-175)

The advisability of building capacitor banks for metal forming (both by swaging and by electrohydraulic forming) is discussed from the following points of view: (1) the utilization of research developed by other companies; (2) the need to train personnel in new techniques (i.e., high voltage); and (3) the possibility of adapting presently available company facilities. E.K.R.

N64-23235* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WELDED ELECTRONIC MODULE FABRICATION
John C. Lyons and David R. Dargo Washington, NASA, Jun. 1964 13 p
(NASA-TN-D-2321) OTS: $0.50

A pilot facility for the fabrication of welded electronic modules was developed to provide a quick-reaction group in the research and development phases of module fabrication, and to determine in detail the requirements in terms of facilities and trained personnel to insure the production of high-quality welded modules. The experience gained in the successful application of the welding technique to modules in Ariel I and Explorer XVIII provided a firm base for using this concept in future spacecraft programs. Author

N64-23236* Rensselaer Polytechnic Inst., Troy, N.Y.
RADIATION DAMAGE TO SEMICONDUCTORS BY HIGH-ENERGY ELECTRON AND PROTON RADIATION
John C. Corelli and H. B. Huntington Washington, NASA, Jul. 1964 71 p refs
(Grant NsG-290)
(NASA-CR-62) OTS: $1.75

Investigation was made of the nature of the defects induced in germanium and silicon by high-energy electrons 5 to 60 Mev and protons of about 10 to 130 Mev. The main probes used are temperature dependence of carrier concentration, conductivity, and carrier lifetime. Analysis indicated the presence of a defect acceptor level at 0.24 ev below the bottom of the conductor band, suggesting the presence of a deep band. Annealing studies indicated stages centered at 75° and 225° C with all but about 10% of the damage removed by heat treatment to 350° C. A.W.

N64-23239 Federal Aviation Agency, Washington, D.C. Communications Development Div.
DEVELOPMENT OF HF WIRE-GRID LENS ANTENNA Interim Report
G. D. Hadorn May 1964 73 p refs
(RD-64-38)

The report contains a qualitative explanation of the principles of operation of the wire-grid lens antenna, a description of the structure and the procedures used for its installation, and a summary of the preliminary performance tests conducted to date. Author

N64-23273 Aircraft Armaments, Inc., Cockeysville, Md.
FOUR-CHANNEL AMPLIFIER ASSEMBLY Final Report
Jun. 1963 48 p
(Contract FAA/ARDS-491)
(ER-2917, REV.)

The result of the work was delivery of five prototype units of a high-reliability four-channel transistorized audio amplifier assembly, meeting all requirements of the specification. Each assembly houses four independent amplifier modules with a frequency response from 300 to 3,000 cps and a gain of 88 db. The assembly also contain two redundant power supplies in the "7" high standard relay panel. Author

N64-23286 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PHOTOGRAPHY AND VISUAL OBSERVATIONS BY MEANS OF HIGH-FREQUENCY CURRENTS
S. D. Kirlian and V. Kh. Kirlian 29 Jan. 1963 17 p Transl. into ENGLISH from Zh. Nauchn. i Prikl. Fotogr. i Kinematogr. (USSR), v. 6, no. 6, 1961 p 397–403
(FTD-TT-62-1549/1+2+4; AD-299666)

A method of producing photographs from the action of high-frequency currents was developed and is described. The method works on the following principle: the nonelectrical properties of the object being photographed are converted into electrical ones through the action of a field with a directed transfer of charges from the object photographic plate. By use of high-frequency capacitor electron–neutron optics the nonelectrical phenomena of living and nonliving objects are converted into electrical ones. R.T.K.

N64-23302 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COLD-CATHODE TUBES
L. N. Korablev 2 Aug. 1963 231 p refs Transl. into ENGLISH from the Book "Lampy S Kholodnym Katodom" Moscow, Izd. Akad. Nauk SSSR, 1961 p 3–175
(FTD-TT-63-422/1+2; AD-422947)

Cold-cathode tubes are discussed generally, operationally, and in application; descriptions are given of the tubes, circuit-design procedures are presented, and the advantages of using the tubes are emphasized. The geographical spread and the scope of their use in the Soviet Union are discussed. G.D.B.

N64-23307 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BOUNDARY CONDITIONS ON IONIZED GAS-SOLID CONTACT SURFACE
G. A. Lyubimov 23 Mar. 1964 13 p refs Transl. into ENGLISH from Prikl. Mekhan. i Tekhn. Fiz. (USSR), no. 4, 1963 p 78–82
(FTD-TT-64-128/1+2+4; AD-435988)

In formulating the boundary conditions for the flow of an electrically conducting medium in a channel, it is necessary to determine the current density of the walls bounding the channel. Since only a current of electrons that have been emitted by the wall (electrode) can flow in a channel, then the magnitude of the current density on the boundary of the channel should depend not only on the magnitude of external resistance, but also on the temperature of the wall and its physical properties. This study shows how the boundary conditions of an electrode can be formulated by taking the physical properties of the electrode material into account. It also shows that an exact formulation of boundary conditions depends on the distribution of emission current in an electrode layer whose density is less than the mean free path of an electron. E.K.R.

N64-23333 Raytheon Co., Newton, Mass. Industrial Components Div.
RESEARCH AND DEVELOPMENT ON TRAVELING IMAGE STORAGE TUBE Interim Engineering Report, 16 Feb. 1964–31 Mar. 1964
Gordon R. Spencer Apr. 1964 15 p
(Contract AF 33(616)-11674)
(IER-2; AD-436037)

A program of applied research and development was undertaken in response to a general Air Force requirement for a display device to be used in aircraft and space vehicles, which will provide a continuously moving, two-dimensional image, generated from information obtained from a line-scan sensor in combination with the forward motion of the vehicle. The feasibility is being investigated of a cathode-ray device employing the following principles and features: (1) tenebrescent (dark-trace) writing and storage; (2) viewing by ambient, reflected light; (3) a continuously moving, variable speed, endless belt target within the tube; and (4) positive, direct mechanical motion coupling through the vacuum envelope. Author

N64-23340* Space Technology Labs., Inc., Rendondo Beach, Calif.
DEMODULATION OF WIDE-BAND FREQUENCY MODULATION BY A PHASE-LOCK TECHNIQUE
Richard C. Booton, Jr. Washington, NASA, Jun. 1964 16 p Presented at the Natl. Telemetering Conf., Washington, May 1962 Submitted for Publication
(Contract NASS-1302)
(NASA-TN-D-1680) OTS: $0.50

The design objective was demodulator capable of handling frequency-modulated television signals. Base-band signals were to be standard 525 line video, with a bandwidth of approximately 3 mc, plus an aural subcarrier at 4.5 mc. Mathematical and physical descriptions of the demodulator, together with theoretical and experimental TV data, are presented. The principal design problem overcome during the development was the decrease of the loop time delay sufficiently to achieve a loop bandwidth of approximately 7.5 mc without stability problems. Monitor pictures are used to compare the performance of the phase-lock demodulator with a conventional discriminator. Author

N64-23341* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE-TRACKING CHARACTERISTICS OF THE X-Y MOUNT FOR DATA ACQUISITION ANTENNAS
Andrew J. Rolinski, Donald J. Carlson, and Robert J. Coates Washington, NASA, Jun. 1964 17 p refs
(NASA-TN-D-1697) OTS: $0.50

Scientific satellite programs demand optimum performance from automatic tracking antenna systems. Certain criteria, such as maximum drive shaft rates and best satellite data transmission conditions, are considered in the design of the antenna mount. In this paper, maximum shaft rates of two-axis mounts are compared under similar satellite pass conditions, and the advantages of using an X-Y antenna mount for data acquisition and satellite tracking functions are discussed. Some general design considerations for servo-control systems, and a discussion relating the error constants to the satellite rates are given. A few salient features illustrating the advantages of the X-Y mount from the servo-drive system designer's viewpoint are also presented. Author

N64-23371 Western Electric Co., Inc., Winston-Salem, N.C.
INDUSTRIAL PREPAREDNESS STUDY: LACQUER FILM CAPACITORS Quarterly Progress Report, 25 Nov.–25 Feb. 1964
J. B. Rawls [1964] 18 p
(Contract DA-36-039-SC-81268)
(QPR-20; AD-436030)

Significant improvement has been made in both the processing techniques and the electrical characteristics of polycarbonate capacitors. Lots are now being produced with high yields on initial lots for dissipation factor, insulation resistance 25° C and 85° C, and effective series resistance. Author

N64-23402 Radiation Inc., Melbourne, Fla.
ON A FUNDAMENTAL PRINCIPLE IN THE THEORY OF PLANAR ANTENNAS Scientific Report No. 1
Donald R. Rhodes 15 May 1964 32 p refs
(Contract AF 19(628)-4007)
(AFCRL-64-331; AD-600765)

A general principle is presented stating that all the properties of any planar antenna can be determined completely from any piece of its TE and TM partial pattern functions. The principle is based on the analytic properties of the pattern functions and on the fact that the aperture and pattern functions are related through the Fourier integral. It applies to much of antenna theory, transient as well as steady-state. An interesting application is an analytic extension of the classical Poynting vector method for determining input reactance, in addition to radiation resistance, of an antenna from its radiation pattern. Author

N64-23412 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RELAXATION PROCESSES IN DIELECTRICS AND SEMICONDUCTORS
P. T. Oreshkin and S. B. Bykov 20 Feb. 1963 18 p refs
Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zaved., Fiz. (Tomsk), no. 3, 1962 p 65–73
(FTD-TT-63-3/1+2+4; AD-299655)

Residual current in the region of intrinsic conduction of aluminum oxide is calculated. The method of calculation may be extended to other dielectrics. A measuring method was developed that makes it possible for us to investigate rather simply the drop of a direct current in dielectrics at high temperature. Experimental data and a comparison with the theory indicate that the current drop in aluminum oxide is associated with thermal ionic polarization and the creation of depletion layers. The initial natural conductivity of aluminum oxide is apparently formed mainly by aluminum ions; the residual current in the presence of small voltages has an ionic component; and at higher voltages it is mainly formed by electrons. Author

N64-23414 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROBLEM OF DEPENDABILITY OF ELECTRIC MOTORS
N. A. Tishchenko 12 Mar. 1963 23 p Transl. into ENGLISH from Elektrichestvo (Moscow), no. 11, 1961 p 7–14
(FTD-TT-63-35/1+2; AD-402437)

This article reflects Soviet concern for the lack of reliability in their electric motors. Principles involved in designing dependable motors are presented, mathematical concepts are set forth, the problems of repair and maintenance are considered, basic causes of failures are described, and quality control is emphasized. G.D.B.

N64-23415 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROBLEM OF RELIABILITY OF ELECTRIC MOTORS
N. A. Tishchenko 18 Mar. 1963 12 p Transl. into ENGLISH from Elektrichestvo (Moscow), no. 12, 1961 p 16–19
(FTD-TT-63-36/1+2; AD-402441)

The reliability of electric motors is studied from the point of view of considering the intensity of the active parts in relation to cost of repairs and maintenance. Mathematical formulas are derived for optimum electric power at minimum cost. The point is made that in the Soviet Union reliability of motors is low and cost is high. G.D.B.

N64-23424 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Dvi.
THEORETICAL PRINCIPLES OF ELECTROSTATIC GENERATORS
Vaclav Hamata 2 May 1963 26 p refs Transl. into ENGLISH from Prace Ustavu pro Elektrotechn. (Prague), v. 7, 1957 p 55–74
(FTD-TT-63-246/1+2+3+4; AD-405716)

The object of this paper is the derivation of a unifying principle for all types of electrostatic generators from the law of electrostatic induction. This law is derived, and the electrostatic current is defined in terms of capacitance and applied voltage. This definition leads to a general equation for an electrostatic generator. With the aid of this equation, electrostatic generators are classified into those having a constant exciting voltage and those having a constant internal capacitance. The principles underlying each of these two groups are examined, and the basic functions are derived. I.v.L.

N64-23427 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STUDY OF THERMAL ELECTRON EMISSION FROM A HOLLOW CATHODE
N. B. Pyt'yeva and Ye. M. Dubinina 13 May 1963 14 p refs Transl. into ENGLISH from Izv. AN SSSR, Ser. Fiz. (Moscow), v. 26, no. 11, 1962 p 1343–1348
(FTD-TT-63-367/1+2+4; AD-405695)

Results of this study indicate the following: (1) Electrons, after emergence from the aperture, possess little scattering with respect to velocity. (2) The edge of the beam originates at the edge of the aperture; the inner parts of the beam originate from the emission from the surface of the upper base of the cavity more distant from the aperture; the central parts originate from the lateral surfaces. (3) Emission from the edge of the aperture is saturated when the anode voltage exceeds 260 volts. (4) The current, within the range of voltages studied ($50 \leq V_A \leq 1000$ v), from the regions of the upper base of the cathode cavity, located at a distance from the aperture greater than the radius, and the current from the lateral surface are bounded by a space charge. (5) The saturation of current from the regions indicated does not proceed at the same time. The boundary of the region of saturations migrates. (6) Variation of the geometric parameters of the cavity, namely its shape and the relationship of the dimensions, may produce a certain change in the structure of the beam. I.v.L.

N64-23438 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF MICROWAVES EMITTED BY RADAR TRANSMITTERS ON THE ORIGINATION OF CATARACTS
Wladyslaw Pol 3 Feb. 1964 16 p refs Transl. into ENGLISH from Lekarz Wojskowy (Warsaw), no. 4, 1962 p 318–327
(FTD-TT-63-1070/1+2; AD-433135)

A survey is made of experiments carried out to determine the effects of microwaves on biological organisms and on the eye, in particular. Upon exposure of the eye to microwaves, symptoms of acute irritability appear in the eye and its surrounding tissue—spasms of the eyelids, tearing, contraction of the pupils, and hyperemia of the conjunctiva and iris, particularly in albinos. Cloudiness of the eye lens may take place, along with inflammation of the cornea, iris, and vitreous body. The intensity of the symptoms depends upon the power of the dosage, time of exposure, and distance of exposed eye from the energy generator. Results of experiments carried out with regard to conditions of cataract origination among animals are not conclusive enough to determine the dose rate that is harmful to the visual organs and to biological organisms in general. P.V.E.

N64-23522* IIT Research Inst., Chicago, Ill. Technology Center
INVESTIGATION RELATING TO THE DEVELOPMENT OF CADMIUM TELLURIDE ENERGY CONVERTERS Quarterly Technical Report No. 2, 11 Oct. 1962–10 Jan. 1963
A. P. van den Heuvel et al 29 Jan. 1963 17 p refs
(Contract NASw-455)
(NASA-CR-56509; ARF-1220-QR-2) OTS: $1.60 ph

A critical consideration of the conditions giving rise to the high quality of the accidentally cast single crystal layer is described. This was necessitated by the failure of experiments designed to grow similar layers. The magnitude of the cadmium vapor pressure, during zone refining, has an adverse effect not only on the production of porous material but also on the tendency of the recrystallized CdTe to stick to quartz surfaces. Reappraisal of all the experiments to date led to a new method of crystal growth that not only solves the sticking problem but also considerably reduces the possibility of bubble inclusion. In essence, the new technique is simply to perform the zone refining vertically so that any bubbles that do form will rise away from the advancing solid–liquid interface. Furthermore, since only a small surface of the material is exposed to vacuum, sublimation is no longer a problem, and the cadmium back pressure is unnecessary. The few boules produced so far have supported these predictions in having highly polished surfaces and being completely free of bubble inclusions despite higher zoning speeds than previously possible. Electrical measurements on samples from the first boule are in progress but were hampered by the unexpected finding that the material is n-type. Author

N64-23523* IIT Research Inst., Chicago, Ill. Technology Center
INVESTIGATION RELATING TO THE DEVELOPMENT OF CADMIUM TELLURIDE ENERGY CONVERTERS Quarterly Technical Report No. 3, 11 Jan.–10 May 1963
A. P. van den Heuvel 14 May 1963 13 p ref
(Contract NASw-455)
(NASA-CR-56512; ARF-1220-QR-3) OTS: $1.60 ph

Development of the vertical zone refining process continued. Several small problems arose in this process. Zone heater failure, intermittent sticking of the cadmium telluride to the quartz tube, and devitrification of the quartz tube in the presence of platinum were all obstacles to final success. However, a new furnace specifically made for this new technique will produce satisfactory results, especially since discovering that a similar approach was used with success on alloys of bismuth telluride by other researchers. The vertical process will be reliable and will optimize those parameters that ultimately determine the performance of CdTe as a solar energy converter. Author

N64-23524* IIT Corp., Easton, Pa. Electron Tube Lab.
DEVELOPMENT OF ELECTRONICALLY-TUNABLE CONVERTERS IN THE MILLIMETER WAVE RANGE Bimonthly Report No. 5, Mar. 16–May 16, 1964
R. W. Wilmarth [1964] 6 p
(Contract NASw-790)
(NASA-CR-56507) OTS: $1.10 ph

The intermediate-frequency effect on the conversion gain of a single-circuit converter was investigated. Cold-test measurements were made on an exactly scaled structure. Effort was concentrated on the spark machining of the slow-wave structure. G.D.B.

N64-23527* Southwest Research Inst., San Antonio, Tex.
A RESISTIVE WHEATSTONE BRIDGE LIQUID WAVE HEIGHT TRANSDUCER Technical Report No. 3
Daniel D. Kana 10 May 1964 18 p refs
(Contract NAS8-11045; SwRI Proj. 02-1391)
(NASA-CR-56551) OTS: $1.60 ph

The resistive-Wheatstone bridge liquid displacement transducer used in present liquid dynamics studies is a reliable device, well suited to liquid amplitude and frequency ranges usually employed for such studies. It appears that at frequencies below 4 cps, its accuracy is within about 3% to 5% when used in ordinary tap water, most of the errors being caused by surface tension effects. If it is possible to use fixed wires without a supporting glass rod, the error due to surface tension effects would be greatly diminished. A number of parameters of the system that can be changed to adapt this transducer to different experimental requirements are listed. N.E.A.

N64-23534 Joint Publications Research Service, Washington, D.C.
REGULARITY OF CHARACTERISTICS OF SECONDARY EMISSION TUBES
A. D. Golubev and S. Ya. Shatz *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 10–19 ref (See N64-23532 16-01) OTS: $3.00

This is an analysis of the experimentally obtained averaged characteristics of secondary emission tubes (LVE) with various coordinate systems; also, an explanation is given of the course taken by these characteristics. Author

N64-23536 Joint Publications Research Service, Washington, D.C.
CONCERNING THE OPERATING STABILITY OF ELECTRIC CIRCUITS WITH ACTIVE UNITS CONTAINING TWO NONLINEAR RESISTANCES
V. V. Sokolov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 28–35 (See N64-23532 16-01) OTS: $3.00

A common criterion is derived for the operating stability of any complex circuit (without reactive units) containing two nonlinear resistances. It proves that under certain conditions a special type of relaxation is possible in circuits containing at least one unit with a negative resistance. Author

N64-23537 Joint Publications Research Service, Washington, D.C.
METHOD OF OPTIMUM ACCELERATION OF ELECTRIC DRIVE UNTIL ITS 3-STATOR MOTOR ROTATES WITH SYNCHRONOUS SPEED

Ye. G. Barabanov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 36–43 refs (See N64-23532 16-01) OTS: $3.00

This article describes a method of obtaining a program that provides the quickest arrangement of an open programed control system by using a step-by-step motor for operation with a frequency that exceeds the pickup frequency. Author

N64-23538 Joint Publications Research Service, Washington, D.C.

THE TORQUE OF TWO-PHASE ASYNCHRONOUS MOTOR CONTROLLED BY AMPLITUDE MODULATED VOLTAGE

Ye. I. Baranchuk and Ye. L. Kovarskaya *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 44–56 refs (See N64-23532 16-01) OTS: $3.00

A method is given for determining the electromagnetic torque of two-phase asynchronous motors having hollow rotors, supplied with power by a semiconductor amplifier, and actuated by a signal consisting of direct and guadrature components. A simplified equation is obtained for the torque of a motor operating in a closed system of control. Author

N64-23539 Joint Publications Research Service, Washington, D.C.

REPRODUCTION OF TANGENTIAL FUNCTION WITH THE AID OF ROTARY SINE-COSINE TRANSFORMER

A. A. Odintsov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 57–65 refs (See N64-23532 16-01) OTS: $3.00

Under consideration is a method of connecting the windings of rotary sine–cosine transformers so that the output voltage is proportional with a certain approximation to the angle of rotation of the rotor. Author

N64-23543 Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF ACCELERATION PICKUP HAVING FILTERING PROPERTIES

K. N. Sergeyev *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 97–108 refs (See N64-23532 16–01) OTS: $3.00

Under consideration in this article is an acceleration pickup whose amplitude-frequency characteristic drops sharply after the resonant zone without reducing the dynamic precision in the measuring band of frequencies. Its advantage over single-mass pickups is illustrated in a case of parasitic high-frequency oscillations. Author

N64-23547 Joint Publications Research Service, Washington, D.C.

EXPERIMENTAL METHOD OF DETERMINING THE EQUIVALENT COEFFICIENT OF THERMAL CONDUCTIVITY OF TRANSFORMER WINDINGS

V. N. Cherkasov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 143–153 refs (See N64-23532 16-01) OTS: $3.00

The method developed for experimental determination of an equivalent coefficient of thermal conductivity of transformer windings is based on the theory of regular heat conditions. It can be also employed for investigating other materials having a thermal conductivity of 0.2 to 1.5 w/m° Author

N64-23548 Joint Publications Research Service Washington, D.C.

HIGH-SPEED COMPARATOR

G. N. Novopashennyy, G. N. Solopchenko, and A. N. Yasenskiy *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR. Instr. Bldg. Ser. 31 Jan. 1964 p 154–156 (See N64-23532 16-01) OTS: $3.00

This article discusses a circuit of a comparator containing semiconductor triodes and one vacuum tube at the input. Brief characteristics are given for the entire comparator and for its individual units. Author

N64-23550 Joint Publications Research Service, Washington, D.C.

PROTECTING THE TRIGGERING ELEMENT OF A CODE

B. Ya. Sovetov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 160–164 refs (See N64-23532 16-01) OTS: $3.00

The action of a multicycle telemechanical system that uses a position code is initiated by the triggering element of the code whose function is to synchronize the transmitting and receiving distributors of the system. The arrival of a triggering element is effected by a triggering device, which assures a single start for the receiving distributor. Author

N64-23569 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

STUDY OF SPECIAL PURPOSE AIRCRAFT ELECTRICAL MACHINES

A. I. Bertinova, ed. 12 Dec. 1963 211 p refs Transl. into ENGLISH of the Book "Issledovaniye Spetsial'nykh Aviatsionnykh Elektricheskikh Mashin" Moscow, Gos. Nauchno-Tekh. Izd. Oborongiz, 1961 p 1–151
(FTD-TT-63-117/1+2; AD-432155)

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B. S. Zechikhin p 167–193 refs (See N64-23578 16-09)

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K. N. Borisov p 194–210 refs (See N64-23579 16-09)

N64-23570 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

DETERMINATION OF PARAMETERS OF MAGNETO-ELECTRIC GENERATORS WITH A "STAR" TYPE ROTOR

A. I. Bertinov and V. G. Andreyev *In its* Study of Special Purpose Aircraft Elec. Machines 12 Dec. 1963 p 3–44 refs (See N64-23569 16-09)

This article deals with the experimental determination of the parameters of magnetoelectric generators with a "star" type rotor, i.e., without the pole shoes. Emphasis is placed on the following: (1) the synchronous inductance of a stabilized symmetrical system; (2) a method of no load and a steady three-phase short circuit; (3) a method of displacement of the axes of two magnetically interconnected machines, one of which is not magnetized; (4) a method of reciprocal load (operation in parallel) of the two interconnected generators of identical capacity; (5) the calculation of synchronous inductance; (6) the calculation of inductances in unstabilized processes; (7) the determination of inductive and equivalent resistances of inverse order; and (8) the determination of inductive and equivalent resistances of zero order. I.v.L.

N64-23571 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE EFFECT OF ALUMINUM FILLING OF ROTORS OF MAGNETOELECTRIC GENERATORS ON THEIR EFFICIENCY

A. I. Bertinov and V. G. Andreyev *In its* Study of Special Purpose Aircraft Elec. Machines 12 Dec. 1963 p 45–53 (See N64-23569 16-09)

Results of the investigations are these: (1) The aluminum filling, which acts as a longitudinal damping system, for the "star"-type rotor causes a marked increase of the degree of utilization of magnetoelectric machines. (2) The higher the capacity of a magnetoelectric machine, the stronger is the action of the aluminum filling as a damping circuit. (3) The application of an aluminum filling as a damping system is not advisable in low-power machines (less than 100 va at 400 hertz) because the increase of voltage does not exceed 2%. (4) The thickness of the side wall of aluminum filling should be selected only on the basis of design considerations. I.v.L.

N64-23572 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE EFFECT OF STEADY LOAD AND TRANSIENTS ON THE FORM OF FIELD AND VOLTAGES OF ELECTROMAGNETIC GENERATORS

A. I. Bertinov and V. G. Andreyev *In its* Study of Special Purpose Aircraft Elec. Machines 12 Dec. 1963 p 55–70 (See N64-23569 16-09)

A study of six-pole and four-pole high-frequency generators, which deliver three-phase and single-phase current, is presented. The rotors are of the "star" type, made from Alnisi and Alnico alloys, and various methods of stabilization are employed. I.v.L.

N64-23573 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CALCULATION OF PERFORMANCE OF ELECTRICAL MACHINES WITH SCREEN EFFECT

A. I. Bertinov and N. V. Sineva *In its* Study of Special Purpose Aircraft Elec. Machines 12 Dec. 1963 p 71–83 refs (See N64-23569 16-09)

The performance of a screening-effect motor, with a current-carrying covering of the ferromagnetic rotor and a metal screen of a nonmagnetic steel, is calculated. An analysis is made of the permeation of the electromagnetic wave into the screen, the current-carrying layer, and the ferromagnetic cylinder. As a result of solving the differential equations for the propagation of the electromagnetic wave for each medium separately (the screen, the current-carrying layer, and the ferromagnetic layer) and the coordination of their solution on the boundary line, the components of induction and the current density for each medium are determined. I.v.L.

N64-23574 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

QUALITATIVE ANALYSIS OF SYNCHRONIZATION OF MOTOR-CONVERTER WITH A SOURCE OF STANDARD FREQUENCY IN THE SYSTEM OF INTEGRAL REGULATOR FOR PRECISION REGULATION OF FREQUENCY

S. R. Mizyurin *In its* Study of Special Purpose Aircraft Elec. Machines 12 Dec. 1963 p 84–112 refs (See N64-23569 16-09)

The system under consideration represents a regulator of the synchronous speed of rotation of direct current motors and assumes the existence of a source of standard frequency in the shape of a quartz or tuning-fork master oscillator. In this stabilized system, the motor is synchronized with the standard source, which actually determines the precision of stabilization of the rotating speed of the motors and the frequency of the converters. Equations are presented for the analysis of the process of synchronization of the motor with the source of standard frequency. I.v.L.

N64-23575 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

EXPERIMENTAL DETERMINATION OF MECHANICAL CHARACTERISTICS OF MOTORS

A. A. Dubenskiy *In its* Study of Special Purpose Aircraft Elec. Machines 12 Dec. 1964 p 113–144 refs (See N64-23569 16-03)

This report discusses these areas: (1) the main methods of the experimental determination of the mechanical characteristics of motors; (2) static and dynamic methods of measuring the torques of motors; and (3) a device for observing the mechanical characteristics of motors directly on a screen. The main units of the device are a hollow aluminum cup, rotated by the motor under test, in a constant magnetic field; a magnet with windings; an amplifier; an electron-beam tube with strong afterglow; a screen; and a rectifier that feeds the amplifier and the electron-beam tube. I.v.L.

N64-23576 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE EFFECT OF ROTOR'S MATERIAL ON THE CHARACTERISTIC OF A MOTOR WITH SOLID ROTOR

N. V. Sineva *In its* Study of Special Purpose Aircraft Elec. Machines 12 Dec. 1963 p 145–156 refs (See N64-23569 16-09)

Formulas and equations are presented for determining the effect of rotor material on such motor characteristics as critical slip and maximum moment. I.v.L.

N64-23577 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PARAMETRIC MOTOR OF RECIPROCATING MOTION
S. R. Mizyurin, Ye. A. Kuznetsov, and S. V. Mayorov *In its* Study of Special Purpose Aircraft Elec. Machine 12 Dec. 1963 p 157–166 ref (See N64-23569 16-03)

A "contactless" motor of reciprocating motion, based on the principle of parametric excitation and utilizing the additional energy of a series resonance circuit, is discussed. The motor can be used for driving various servomechanisms with reciprocating motion, for driving impact instruments, for vibrating strands, and also for driving servomechanisms with rotating motion (the conversion of reciprocating motion into rotating motion). I.v.L.

N64-23578 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MAGNETIC FIELD IN THE GAP OF THE INDUCTOR MACHINE WITH PULSATING FLUX OF ROTOR'S TOOTH
B. S. Zechikhin *In its* Study of Special Purpose Aircraft Elec. Machines 12 Dec. 1963 p 167–193 refs (See N64-23569 16-09)

A strict analytical solution is presented of the problem of the determination of the magnetic field in the gap of an inductor generator. The generator has open slots on the rotor and stator, identical geometrical configuration of rotor and stator teeth, and arbitrary displacement of the axes of the rotor and stator slots. The field in the gap of the inductor generator is recorded in the form of a system of linear algebraic equations. The form of the equations is applicable for the numerical determination of the field in the gap by means of calculating machines. I.v.L.

N64-23579 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONCERNING THE PROBLEM OF THEORY OF IMPULSE VOLTAGE REGULATION AT EQUIVALENT LOAD
K. N. Borisov *In its* Study of Special Purpose Aircraft Elec. Machines 12 Dec. 1963 p 194–210 refs (See N64-23569 16-09)

A new mathematical representation of the character of impulse regulation is presented. This new representation introduces the concept of the resistance of distortion. I.v.L.

N64-23602 Mictron, Inc., Albany, N.Y.
C.W. X-BAND VOLTAGE TUNABLE OSCILLATOR Second Quarterly Progress Report, 1 Oct.–31 Dec. 1963
M. R. Boyd and M. Weinstein Dec. 1963 23 p
(Contract DA-36-039-AMC-03270(E))
(Rept.-2; AD-435136)

RF testing and analysis of results of tubes at lower frequencies was continued. The methods and techniques for fabricating the complicated parts required for the designs at higher frequencies were developed. Construction and testing of advanced designs were also commenced during this period. Author

N64-23646 California Inst. of Tech., Pasadena Antenna Lab.
ON THE THEORY OF NOISE-LIKE ELECTROMAGNETIC FIELDS OF ARBITRARY SPECTRAL WIDTH
Alexander D. Jacobson Jun. 1964 214 p refs
(Contract AF 49(638)-1266)
(TR-32; AFOSR-64-0804; AD-600454)

A mathematical theory of noise-like electromagnetic fields of arbitrary spectral width is formulated. Attention is restricted to fields whose random fluctuations result exclusively from the chaotic nature of the source. The theory is expressed in terms of the second-order moment of the field vector; hence, it is a tensor theory. Moreover, to make it applicable to fields of arbitrary spectral width, the theory is formulated in terms of a spectral representation, rather than directly in terms of the autocorrelation function of the vector field. The principal field quantity, the dyadic field spectral density (DFS), is interpreted from both a statistical and a physical standpoint. In particular, a statistical analysis of partial polarization is presented with the aim of providing a physical interpretation of the polarization of a quasi-monochromatic field. The differential equations that govern the behavior of the DFS are derived in the presence of a source, in a source free region, and in a generalized dielectric medium. Boundary conditions are derived for the DFS at a dielectric interface, at a perfectly conducting interface, and at infinity. Author

N64-23699 Bureau of Mines, Reno, Nev. Reno Metallurgy Research Center
ELECTRICAL RESISTIVITY OF CERIUM METAL FROM 4° TO 300°K
R. D. Smith and E. Morrice 1964 17 p refs
(BM-RI-6480)

Thermal expansion and electrical resistance measurements were made on cerium metal from 4° to 300° K. The apparatus developed, including a specimen holder and a cryostat system, are described along with the experimental techniques used in obtaining the measurements. The total linear thermal expansion of 99.83 weight-% cerium metal between 4° K and room temperature was 4.24%. The resistivity at 4° K was 7.0×10^{-6} ohm-cm. Data at 4° K indicate a fundamental relationship between residual resistivity and purity of cerium metal. The effects of annealing and repeated thermal cycling on resistivity were determined. Author

N64-23718 Geophysics Corp. of America, Bedford, Mass. Viron Div.
THE POTENTIAL OF EXPANDED ALUMINUM MESH FOR INFLATABLE RIGIDIZED RADAR REFLECTIVE DEVICES
L. J. Boler *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 381–396 refs (See N64-23701 16-09)

The potential of expanded aluminum mesh as a material for use in inflatable, rigidized, radar reflective devices is investigated. An optimized material for inflatable, rigidized, radar reflective devices must be lightweight, capable of rigidity, have open area, possess long space life, and have the capacity to be fabricated. J.R.C.

N64-23729 Birdair Structures, Inc., Buffalo, N.Y.
INFLATABLE SPACE ANTENNA SYSTEM
G. F. Reitmeier *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 605–612 (See N64-23701 16-01)

The design, development, and fabrication of a series of active inflatable space antenna systems is discussed. Each antenna system, which is comparable in size to a compact automobile, is an assembly of complex inflatable shapes arranged and held to extremely close dimensional limitations. Some of the major problems involved in the development of the antenna system, from a mechanical viewpoint, were the development of materials suitable for inflation and rigidization in a space environment, development of a container and pressurization system, providing required RF performance and reliability with minimum weight, and the development of folding and deployment techniques for a relatively complex inflatable configuration. Author

N64-23795 Joint Publications Research Sevice, Washington, D.C.
SOLUTION OF TRAVELING WAVE TUBE EQUATIONS WITH THE AID OF TRIGONOMETRIC SERIES
A. F. Golubentsev *In its* Izv. VUZov: Radiophys. 18 May 1964 p 136–144 refs (See N64-23783-29) OTS: $5.00

A new method is proposed for the determination of TWT amplification by means of a trigonometric series, the coefficients being fraction-rational functions of Pierce's parameters. The method is based on the representation of the amplification factor in the form of a complex integral and can be easily applied to other UHF electronic devices with continuous interaction. Author

N64-23798 Joint Publications Research Service, Washington, D.C.
HARMONIC ACTION ON A SYSTEM OF TWO CIRCUITS COUPLED BY A NONLINEAR CAPACITANCE
V. M. Bogachev and Yu. A. Kravtsov *In its* Izv. VUZov: Radiophys. 18 May 1964 p 172–194 refs (See N64-23783 16-28) OTS: $5.00

By the method of slowly varying amplitudes the reaction is considered for a two-circuit system with a nonlinear coupling capacity under the influence of a harmonic force of frequency ω, which is approximately equal to the eigenfrequencies (Ω_1 or Ω_2). It is shown that at the approximation of volt–coulomb capacity characteristics by the quadratic trinomial and at the ratio of eigenfrequencies $\Omega_1/\Omega_2 \simeq 2$, the hysteresis phenomena are possible both at $\omega \simeq \Omega_1$ (frequency divider) and at $\omega \simeq \Omega_2$ (frequency multiplier). The influence of strong static coupling between circuits is taken into account. Author

N64-23799 Joint Publications Research Service, Washington, D.C.
CONTRIBUTION TO THE THEORY OF THE LR TRANSISTOR OSCILLATOR
N. I. Ashbel and L. V. Postnikov *In its* Izv. VUZov: Radiophys. 18 May 1964 p 195–211 refs (See N64-23783 16-28) OTS: $5.00

The calculation method of auto-oscillating transistorized circuits has been applied to the dynamic investigation of an LR oscillator by using the static model of a transistor. The division of phase plane portion into regions of linearity was made, the distribution of equilibrium states in each region was found, and the stability of these states was examined. Author

N64-23800 Joint Publications Research Service, Washington, D.C.
DETERMINATION OF OPTIMAL CHARACTERISTICS OF REGULA-SYSTEMS WITH MODULATION
S. V. Shil'man *In its* Izv. VUZov: Radiophys. 18 May 1964 p 212–230 refs (See N64-23783 16-28) OTS: $5.00

Optimal characteristics are determined for a system of modulation for the case of an infinite interval of observation and a stationary input signal. The problem can be reduced to the solution of integral equations of the Wiener–Hopf type; methods of an approximate solution of these equations are given. Author

N64-23801 Joint Publications Research Service, Washington, D.C.
CONCERNING ONE OPTIMAL CONTROL PROBLEM
V. P. Savel'yev *In its* Izv. VUZov: Radiophys. 18 May 1964 p 231–243 refs (See N64-23783 16-28) OTS: $5.00

A problem is considered of optimum control (relative to the traveling time) of the electric locomotive under certain restrictions or speeds of locomotive and without any of its engines overheating. The control obtained with the help of necessary conditions of L. S. Pontriagin's maximum principle is proved to be really optimum. Author

N64-23802 Joint Publications Research Service, Washington, D.C.
STABILITY OF SYSTEMS OF EXTREMAL REGULATION WITH CONSTANT SEARCH SPEED
B. A. Aref'yev *In its* Izv. VUZov: Radiophys. 18 May 1964 p 244–257 refs (See N64-23783 16-28) OTS: $5.00

The extremum search process has been examined in common systems with a constant modulus of speed for the input value, the characteristic being shifted with a constant speed in any direction. The object inertia is taken into account, as well as the commutator interference in the search process, causing the forced reverses of the initiating element. Author

N64-23874 General Electric Co., Pleasanton, Calif.
INVESTIGATION OF THERMIONIC CONVERTER OPERATING WITH A HIGH TEMPERATURE COLLECTOR **First Quarterly Technical Report**
E. Blue and J. H. Ingold May 1964 41 p
(Contract AF 33(615)-1545)
(GEST-2034; AD-601007)

An investigation is made of the performance of a thermionic converter with a high-temperature collector. An uncooled collector electrode was used to permit measurements for the higher range of collector temperatures. A new design for the cooled collector electrode was developed that should greatly improve the reliability of the cooled electrode. The converter with an uncooled collector electrode was assembled and processed, yielding vacuums below 10^{-6} in the electron bombardment chambers and below 10^{-7} in the cesium envelope. J.R.C.

N64-23876 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ANTENNAS
Khristo Dimitrov Shinev 19 Dec. 1963 486 p refs Transl. into ENGLISH of the Book "Anteni" Sofiya, Durzhavno Izd. Tekhn., 1960 p 1–410
(FTD-TT-62-1826; AD-429454)

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N64-23877 Itek Corp., Lexington, Mass.
THE APPLICATION OF PHOTOGRAPHIC PHOTOMETRY TO ELECTRONIC DISPLAY SYSTEMS **Scientific Report No. 1**
Lloyd C. Sanford, David I. Harvey, and Robert J. Kohler Jan. 1964 22 p refs
(Contract AF 19(604)-8467)
(AFCRL-64-271; AD-601632)

A technique for determining absolute luminance of objects as viewed by an orbiting Tiros satellite is described. Because the Tiros system was designed to provide qualitative rather

than quantitative photographic data on meteorological conditions, cloud formations, geographic location of storm centers, etc., it was necessary to perform an analysis of the discontinuities and nonuniformities in the photoelectronic portion of the system that distorted the luminance display. The assignment of luminance values to the viewed object, as imaged ultimately in photographic film, involves the alteration of object luminances by the satellite-borne, optical-electronic imaging system, the conversion of illuminance to telemetered signal, the transmittal of this information to a ground receiving station, the ground monitor cathode-ray tube (CRT), and the photographic recording and development processes. Each of the factors altering the luminance transfer were quantitatively evaluated to allow the determination by the satellite system of cloud luminance. Author

N64-23883 Lockheed Missile and Space Co., Sunnyvale, Calif.
MICROMINIATURIZATION; ITS APPLICATION TO ELECTRONIC CIRCUITS AND COMPONENTS: AN ANNOTATED BIBLIOGRAPHY
Jack B. Goldmann, comp. Jun. 1963 60 p refs
(Contract AF 04(647)-787)
(SB-62-67; Rept.-3-35: 62-8; AD-410235)

Thin films, micromodules, solid-state devices and dot circuits are included in the aspects of microminiaturization of electronic circuits and components with which this annotated bibliography of 1962 publications is concerned. Particular emphasis is made in the direction of manufacturing development research and evaluation techniques. Author

N64-23888 Hughes Research Labs., Malibu, Calif.
RESEARCH ON MILLIMETER-WAVE TUBES Interim Engineering Rept. No. 4, Apr. 1963–Mar. 1964
D. C. Forster May 1964 87 p refs
(Contract AF 33(657)-11116)
(AD-600945)

This program is a feasibility study of a 5-mm amplifier that will eventually deliver 30 w of CW power at 2 min. Extensive work on gun design has resulted in a gun that is satisfactory for use in the 2-mm tubes to be built. Three 5-mm tubes have been fabricated and evaluated for RF performance. Feasibility of the eventual 2-mm design has been established. Author

N64-23894* Purdue U., Lafayette, Ind.
DYNAMIC RESPONSE OF A HYDROELECTRIC PLANT
R. Oldenburger and J. Donelson, Jr., (TVA, Chattanooga) Repr. From Power Apparatus and Systems, Oct. 1962 17 p refs Presented at AIEE Winter General Meeting, New York, N.Y., 28 Jan.–2 Feb. 1962
(Grant NsG-28-59)

Frequency-response tests were made on turbines to check the validity of previously derived mathematical expressions. These tests confirmed in general that the mathematical expressions could be used to describe the performance under all major operating conditions and for the direct design of nonlinear power system controls. Hydraulically, this is the most complicated installation east of the Rockies. Author

N64-23907 Motorola, Inc., Scottsdale, Ariz. Military Electronics Div.
RESEARCH ON SURVEILLANCE RADAR RECEIVERS AND TRANSPONDERS Seventh Quarterly Progress Report, 1 Nov. 1963–31 Jan. 1964
R. C. Havens, C. A. Adams, F. R. Voorhaar, D. E. Allen, and J. A. Barkson Jan. 1964 46 p refs
(Contract DA-36-039-Sc-90700)
(WP-2785-7; AD-436043)

An X-band waveguide tunnel diode amplifier exhibiting a 5.4 db noise figure, a gain bandwidth product of 5 Gc, and tunable from 8.6 to 9.6 Gc is discussed. Performance data for a commercially available X-band tunnel diode amplifier are also presented. A theoretical analysis of a subharmonic pumped parametric amplifier applicable at X-band frequencies and based on the assumption of sinusoidal current pumping is presented. Third subharmonic pumping is shown to be impractical; however, second subharmonic pumping is shown to be feasible at X-band with present state-of-the-art varactors. A miniaturized solid-state local oscillator having 2 to 3 mw power output at 9.3 Gc and tunable over 100 mc is also discussed. The device is stable to within ±6 mc over the range of −55° to +90° C. Author

N64-23913* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
ANALYSIS OF A DISTRIBUTED SUPERCONDUCTIVE ENERGY CONVERTER
Andrew R. Sass Repr. from IEEE Trans. on Aerospace, v. 2, no. 2, Apr. 1964 p 822–825 refs
(NASA-RP-202)

An equivalent circuit for a distributed superconductive energy converter, the operation of which is based on the principle of flux conservation in superconducting loops, is presented. The Laplace transformation is used to analyze the circuit, and the solutions are examined in order to optimize the operation of the device. While previously only d.c. operation of such a device has been realized, it is shown that under certain conditions a low frequency a.c. mode can be achieved. Author

N64-23916 Mallory (P.R.) and Co., Inc., Burlington, Mass. Lab. for Physical Sci.
CELL EQUALIZATION TECHNIQUES Quarterly Technical Progress Report, 1 Jan.–1 Mar. 1964
F. J. Cocca [1964] 14 p
(Contract AF 33(615)-1342)
(AD-435833)

There are two modes of operation for a stabistor charge control circuit—thermal coupling the stabistor to the cell and thermal isolation of the stabistor from the cell. Circuits demonstrating each technique are under test. Preliminary investigations indicate that a germanium power transistor may be used more effectively as an antireversal diode than the germanium diode now being used. Attempts to fabricate a backward diode were fruitless. Author

N64-23920* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF NON-LINEAR NOISE IN FDM TELEPHONY TRANSMISSION OVER AN SSB-PM SATELLITE COMMUNICATION SYSTEM
Paul S. Hefferman Washington, NASA, Jul. 1964 30 p refs
(NASA-TN-D-2365) OTS: $1.00

This report analyzes the noise produced by dynamic nonlinearity in elements of the SSB up-link, spacecraft phase modulator, and ground receiver demodulator. Worst-case channel signal-to-nonlinear-noise power ratios are developed in terms of the coefficients of a power series expressing the nonlinear characteristic. The group delay problem is not treated. Discussed in detail are the calculation of the autocorrelation function, the evaluation of spectral convolutions, the determination

of the power series coefficients, and CCIR terminology and multichannel loading procedures for FDM telephony. Author

N64-23924 Illinois U., Urbana Coordinated Science Lab.
OPTIMAL LINEAR SWITCHING FOR SINGULAR LINEAR SYSTEMS
R. A. Roher and M. Sobral, Jr. Mar. 1964 28 p refs
(Contract DA-36-039-AMC-02208(E))
(R-196; AD-435680)

The bounded-input control of a linear, time-invariant system with quadratic performance index is discussed from the standpoint of simple implementation. In particular the admissible control is constrained to be a linear function of the states fed back through a saturating amplifier. The resulting controlled system not only exhibits the usual maximum effort made of operation, but also the terminal singular behavior where linear control is in evidence. Author

N64-23938* Gulton Industries, Inc., Hawthorne, Calif. Engineering Magnetics Div.
RESEARCH AND DEVELOPMENT STUDY ON DC TO DC CONVERTER ENGINEERED MAGNETICS MODEL EMCR-131 Third Quarterly Report, 1 Jan.–1 Apr. 1964
Lewis Hemphill [1964] 11 p ref
(Contract NAS5-3470)
(NASA-CR-56467; Rept.-1419) OTS: $1.60 ph

The design of a highly efficient d.c. to d.c. converter consisting of four regulated, isolated, and short-circuit-protected outputs is discussed. The design of the regulation control loop and series regulator circuits was optimized. In order to accomplish this, it was found necessary to compromise and obtain less than the desired efficiency because of the deviation of the regulating loop from its theoretical performance. In analyzing this problem, an alternate approach was designed in order to maintain the desired converter efficiency. R.T.K.

N64-23948* Space Technology Labs., Inc., Redondo Beach, Calif.
STUDY OF SPACECRAFT TRANSPONDER POWER AMPLIFIER Third Quarterly Report, 1 Jan.–31 Mar. 1964
R. R. Cagnon and S. D. Mc Caskey [Mar. 1964] 38 p refs
(Contract NAS5-3423)
(NASA-CR-56287) OTS: $3.60 ph

Work was carried out primarily in two areas: (1) analysis of intermodulation distortion and (2) down converter development—the down converter for the reentrant traveling wave tube system is required to convert signals in the band 5.925 Gc to 6.425 Gc to the frequency band 3.7 Gc to 4.2 Gc, by means of a local oscillator of 10.125 Gc. P.V.E.

N64-23949* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VOLTAGE AND CURRENT MONITOR FOR SCIENTIFIC SATELLITES
Warren R. Crockett 15 Feb. 1964 32 p refs
(NASA-TM-X-51659; X-631-64-35) OTS: $3.60 ph

A description is given of a voltage and current monitor applicable to spacecraft technology comprised of a self-balancing magnetic-amplifier circuit using direct current. This circuit has measured currents as low as 1 μamp and voltages as high as 10,000 volts. Power consumed may vary from less than 1 mw to approximately 8 mw, depending on the load required. In spacecraft applications the telemetry system may present a load varying from 1,000 ohms to 20,000 ohms; under these conditions, the power consumed by the monitor is in the order of 8 mw. With the aid of a voltage against frequency calibration curve, the magnitude of the spacecraft voltage or current being monitored can be determined. A.W.

N64-23952 Electronic Communications, Inc., Timonium, Md. Research Div.
PSEUDO RANDOM ARRAY INVESTIGATION Final Report
S. W. Sherman and M. I. Skolnik Griffiss AFB, N.Y. RADC, May 1964 208 p refs
(Contract AF 30(602)-3057)
(RADC-TDR-64-43; AD-601663)

This report describes an investigation into the application of dynamic programing to antenna array theory. The investigation relied heavily on the use of high-speed computers to design both linear and planar arrays. These arrays were composed of unequally spaced isotropic elements where the element positions were chosen to minimize the peak sidelobes of the far field pattern. An evaluation of these patterns is performed in establishing guidelines for antennas that operate with element reductions of 80% to 95%. Author

N64-23953 Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
FAILURE MECHANISMS IN MICROELECTRONICS Second Quarterly Report, Aug.–Oct. 1963
Griffiss AFB, N.Y., RADC, May 1964 71 p refs
(Contract AF 30(602)-3017)
(RADC-TDR-64-61; AD-601814)

A series of 12 wafers with 625 devices each, fabricated in p-type, 10.4-ohm-cm silicon were processed through all fabricational stages, and measurements were made on the surface parameters at each stage of fabrication; in certain ones device characteristics were measured on individual devices on the wafers as a function of position, and results are compared with the values of the surface measurement parameters previously obtained for the same device or area on the wafer during the processing stages. Present indications show variation in characteristics with position on the wafer, and that the two most drastic stages in fabricational processing affecting surface properties are the vapor etch and the photoetch. Author

N64-23954 Polytechnic Inst. of Brooklyn, N.Y.
ELECTROMECHANICAL PULSERS
Enrico Levi Griffiss AFB, N.Y., RADC, May 1964 23 p refs
(Contract AF 30(602)2149)
(PIBMRI-1129-63; RADC-TDR-64-109; AD-601569)

Considered is the feasibility of generation of high-energy pulses directly by electromechanical power conversion, without relying on intermediate storage in electrical form. Extremely large values of power output per unit volume of the machine can be obtained, within the ambit of present day technology, when the materials are pushed to the limit set by tensile strength. As an example, units having overall dimensions comparable with those of a medium-sized turbogenerator can be built to deliver energies up to 10^{10} Joules in one second and 10^{8} Joules in a few milliseconds. Guiding principles for the design of these generators are presented. General relations governing the performance of converters employing hot plasmas are established. Author

N64-23957 Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
FAILURE MECHANISMS IN MICROELECTRONICS Third Quarterly Report
Griffiss AFB, N.Y., RADC, May 1964 30 p refs
(Contract AF 30(602)-3017)
(RADC-TDR-64-125; AD-601819)

A specific microelectronic linear amplifying block was chosen as the representative device for detailed examination. This device contains 4 diodes, 2 field effect devices, 6 transistors, and 20 resistors of different values, and is so designed that maximum flexibility of interconnection is possible to adapt it to various circuit applications. Its primary use is as an amplifying block, e.g., a multistage amplifier. By slight modification of the fabricational steps, it is possible to incorporate avalanche diodes and metal-oxide-silicon capacitors into the device. A description is given of the block, and its performance characteristics are indicated. Measurements were made on this block, utilizing measurement and analysis of traditional characteristic curves on the curve tracer, reverse breakdown measurements of resistor isolation, photovoltaic response at the aluminum contacts, and microscopic examination of the surface laid bare by successive angle lappings. The results are described.

Author

N64-23960 Clevite Corp., Palo Alto, Calif. Shockley Research Lab.

FAILURE MECHANISMS IN SILICON SEMICONDUCTORS Fourth Quarterly Report, 30 Nov. 1963–29 Feb. 1964

W. Schroen, W. W. Hooper, and H. J. Queisser Griffiss AFB, N.Y., RADC, May 1964 65 p refs

(Contract AF 39(602)-3016)

(RADC-TDR-64-153; AD-601820)

This report consists of two parts. The first part describes investigations of surface phenomena on oxide-protected silicon devices. The problem of surface breakdown is considered. Surface breakdown voltage can be altered by supplying charge to surface states either by illumination or field effect. Junctions with anomalous local regions are investigated, showing spots of high sensitivity to light. A quantitative relationship between surface breakdown and contact potential was difficult to obtain. SiO_2 resistance was measured. A resistance "drift" was observed, with a time constant of approximately 15 minutes. This report also discusses further investigations of current concentrations in silicon power transistors when thermally induced breakdown is produced("second breakdown" phenomenon). Most emphasis was put on transistors exhibiting low contact resistance between aluminum contact and emitter silicon. Two types of transistors were investigated: those that showed second breakdown at spots of elevated temperatures ("hot spots") and those that showed second breakdown at spots initially not included in areas of elevated temperatures. Investigations of transistors with deliberate thin spots were continued; first experiments using simplified structures were started.

Author

N64-23961 Watkins-Johnson Co., Palo Alto, Calif.

WIDE BAND ELECTRONICALLY TUNABLE FILTERS

A. W. Shaw [1964] 97 p refs

(Contract AF 30(602)-2625)

(W-J 64-609R24; RADC-TDR-64-170; AD-601662)

Work in the area of electrically tunable filters using YIG and GaYIG resonators is reported. Ten filters are described. Most of these filters are nonreciprocal. Filter design, temperature compensation, linearity and hysteresis, and magnetic shielding are discussed.

Author

N64-23963 Watkins-Johnson Co., Palo Alto, Calif.

DEVELOPMENT OF A DOUBLE OCTAVE BANDWIDTH TRAVELING-WAVE TUBE AMPLIFIER

B. P. Israelsen and F. T. Mauch Griffiss AFB, N.Y., RADC, May 1964 24 p refs

(Contract AF 30(602)-3261)

(RADC-TDR-64-199; AD-441581)

The purpose of this program is the attainment of low-noise amplification over two octaves in a single traveling-wave tube. Noise figure is to be less than 6 db from 2.0 to 8.0 Gc, with a minimum of 10 mw saturated power output. The work has been aimed primarily at raising the power output to the required 10-mw level. This has been sought through the use of a severed helix, with the output section operating with higher voltage and lower γa than the input, or low-noise section. Good results have been obtained with this method, the power output being greater than 10 mw over virtually the entire band.

Author

N64-23970 Lockheed Missiles and Space Co., Palo Alto, Calif.

LIMITED-CYCLE SECONDARY BATTERY USING LITHIUM ANODE Final Report, Jun. 1963–Mar. 1964

H. F. Bauman Wright-Patterson AFB, Ohio, Aero Propulsion Lab., May 1964 36 p refs

(Contract AF 33(657)-11709)

(APL-TDR-64-59; AD-601128)

The lithium–cupric fluoride and lithium–cobaltic fluoride electrochemical systems were investigated with eventual battery development as the goal. Specific conductivities of $13.4 \times 10^{-3}\Omega^{-1}cm^{-1}$ and $6.8 \times 10^{-3}\Omega^{-1}cm^{-1}$ were experimentally determined for solutions of sodium hexafluorophosphate in butyrolactone and propylene carbonate. Both of these electrolytes showed little structural change as indicated by infrared spectra change after 60 days at 165° F in contact with cupric fluoride or cobaltic fluoride. Both cupric fluoride and cobaltic fluoride are insoluble in the electrolyte solutions under similar conditions. Aluminum, silver, stainless steel, polyolefins, and fluorinated polyolefins are inert in these electrolytes. Cells with reference electrodes showed lithium anode polarization of 70 mv during a 100-hr discharge at 1 ma/in.^{2} in $NaPF_6$–propylene carbonate and 150 mv under similar conditions with $NaPF_6$–butyrolactone electrolyte. Approximately 90% utilization of lithium was achieved in these tests. Cupric fluoride cathodes were prepared from cupric fluoride–silver flake blends. Utilization of 72% was achieved for cupric fluoride to 1.5-v polarization, which is approximately equivalent to a 2.0-v cell endpoint. Values of 128 w-hr/lb of electrodes or 24 w-hr/lb of electrodes and electrolyte actually used were obtained during these tests. Aluminum-cased cells discharged with a profiled load rate had lower weight-to-energy figures than the previous test cells. Figures of 4 to 15 w-hr/lb of electrode and electrolyte were obtained at 1.2 to 0.6 ma/in.^{2} current density to a 2.0-v endpoint. A successful cobalt fluoride cathode was not made. Theoretical voltage was obtained on open circuit, but none of the electrodes constructed would sustain significant discharge at 1 ma/in.^{2}.

Author

N64-23973 Quantum, Inc., Wallingford, Conn.

ORGANIC SEMICONDUCTOR DEVELOPMENT Final Report

P. M. La Flamme and R. L. Taylor 21 Apr. 1964 68 p refs

(Contract AF 19(628)-2839)

(AFCRL-64-389; AD-601862)

The organic semiconducting materials magnesium-bis(4,4'-dipyridyl) and 4-isonitrilothioanisole were synthesized. A satisfactory method of preparing and purifying the unstable 4-isonitrilothioanisole was established. Preliminary conductivity measurements were carried out on the synthesized materials, two carbene dimers, and certain derivatives of the carbenes. These materials exhibit significant conductivity properties. The unstable isonitrile undergoes a reaction at room temperature giving what is thought to be a low polymer of the isonitrile. This material exhibits a strong EPR spectrum. A new type of electrical conductivity cell was designed and used for all conductivity measurements.

Author

N64-23974 ARO, Inc., Arnold Air Force Station, Tenn.
TITANIUM GETTERING OF CHEMICALLY INACTIVE GASES BY MEANS OF IONIZATION
B. A. Mc Cullough and S. M. Kindall Arnold Eng. Develop. Center, Jun. 1964 34 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-83; AD-601604)

This report deals with an exploratory experimental study of gas ionization to enhance the removal of chemically inert gases from a titanium getter pump. Gas ionization was accomplished in the free-molecule region by bombardment of the gas molecules with the electrons of a diode current where the anode was specially designed to produce a high-density region of ionizing electrons. The pumping speeds for argon, methane, and helium were experimentally measured. The dependence of ion pumping speed on the rate of titanium evaporation was observed and is discussed in terms of the mechanism of ion removal. Author

N64-23975 Ohio State U. Research Foundation, Columbus Antenna Lab.
FOCUSING OPTICS FOR INTENSE LASER SOURCES
Edward K. Damon 15 Dec. 1963 40 p refs
(Contract AF 33(657)-10824)
(Rept.-1579-6; AD-441643)

Problems associated with the focusing and control of extremely intense laser beams are examined. It is shown that an optical system resembling a classical Galilean telescope is suitable, in principle, for such a task; the design procedure for such a system is demonstrated for typical examples. It is possible to correct the aberrations of such a system to give excellent performance, and the correction is essential in order to hold spherical aberration to a tolerance level. The use of spheric surfaces or zonal correction plates can further improve the performance of such a system if the original laser beam is highly collimated. J.L.D.

N64-24006* Illinois U., Urbana
POLARIZATION MEASUREMENTS DURING SCINTILLATION OF RADIO SIGNALS FROM SATELLITES
J. P. Mc Clure Repr. From J. Geophys. Res., v. 69, no. 7, 1 Apr. 1964 p 1445–1447 refs
(Grant NsG-24-59)

This is a brief review of measurements obtained from Transit 4A. Charts are given that show segments of satellite records, including dipole, turnstile, and polarimeter (antenna–goniometer–receiver combination) signal strength channels, and a goniometer reference mark, which is applied once per goniometer shaft revolution. The conclusions reached from the analysis of four months of polarimeter data are the following: (1) During sufficiently weak scintillation, the axial ratio and polarization angle of the downcoming wave are unchanged. Only the magnitude of the signal is seen to scintillate. (2) For stronger scintillation, the axial ratio and polarization angle exhibit random variations superposed on their regular variations. (3) The random polarization angle variations observed were never large enough to obscure the regular Faraday effect at 54 mc during the period March through June 1963. At a lower frequency or at a time of more severe scintillation, this may no longer be the case. IAA

N64-24026* Wheeler Labs., Inc., Great Neck, N.Y.
DEVELOPMENT OF MACROSCOPIC OPTICAL WAVEGUIDE COMPONENTS Progress Report, Apr. 1964
Henry W. Redlien 9 May 1964 5 p refs
(Contract NASw-888)
(NASA-CR-56569) OTS: $1.10 ph

Analysis of propagation in dielectric waveguides, surveying and studying of material and fabrication techniques required for construction of optical components, and experimental testing of waveguides considered suitable for component fabrication were performed during the reporting period. The analysis of waveguide theory was completed, and a "mode chart" for circular dielectric waveguides was prepared. Several configurations of waveguides were studied and materials procured. Experimental testing demonstrated the feasibility of the waveguide operation. P.V.E.

N64-24027* Astropower, Inc., Newport Beach, Calif.
DEVELOPMENT OF A PROTOTYPE 30-WATT TUNNEL DIODE INVERTER Final Report, Jul. 1962–Dec. 1962
R. E. Smith and W. A. Bierley 29 Mar. 1963 48 p ref
(Contract NAS5-2712)
(NASA-CR-56570; Rept.-111-F) OTS: $4.60 ph

Procedures have been developed for the construction of a low-voltage, high-current inverter using tunnel diodes. A prototype tunnel diode inverter used eight 100-amp peak-current tunnel diodes as switches, with four diodes operating in parallel as one switch. It produced 22.5 w of output power at 50 v rms, with a frequency of 50 cps, when driven by a 0.25-v d.c. voltage source. At this output the efficiency was 20%; efficiencies of 42%, compared with a theoretical figure of 49%, were obtained at the 100-amp input level. Author

N64-24029* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
INVESTIGATION OF THE DSIF 85-FOOT ANTENNA STRUCTURAL DEFLECTIONS CAUSED BY DEADLOAD AND THERMAL INPUTS
Floyd W. Stoller 7 Aug. 1962 102 p
(Contract NAS7-100)
(NASA-CR-56282; JPL-TM-33-94) OTS: $9.10 ph

An investigation was made of the tracking discrepancies found in the data of the Australian and South African Deep Space Instrumentation Facility (DSIF) stations. Test equipment in development was employed to determine the sources of these errors. Measurements were made on the 85-ft antenna at the DSIF Station No. 5 (South Africa) of the quadripod, dish structure, and pedestal deflections due to deadload and thermal inputs. The report includes discussions of the problem, the test program, data-processing procedures and reduction mechanization, and data reduction. Auxiliary investigations are described, the test results are analyzed, and recommendations, both current and future, are made to correct or eliminate tracking errors. Author

N64-24046* Mallory (P.R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science
RESEARCH AND DEVELOPMENT OF A HIGH CAPACITY NON-AQUEOUS SECONDARY BATTERY Third Quarterly Report
[1964] 47 p
(Contract NAS3-2780)
(NASA-CR-56463) OTS: $4.60 ph

Investigations were conducted on electrolytes employing a propyline carbonate solvent. Lithium exhibits completely satisfactory behavior insofar as the current efficiency for deposition is concerned. Iron, cobalt, and nickel metals appear not to function satisfactorily in a cathode couple. Silver is reversibly oxidized in chloride containing electrolytes on cathodization to an insoluble salt, whereas copper is reversibly oxidized to a salt in chloride and fluoride electrolytes. J.R.C.

N64-24048* Advanced Kinetics, Inc., Costa Mesa, Calif.
MAGNETIC FORMING COIL DESIGN AND DEVELOPMENT Summary Report
R. W. Waniek, H. P. Furth, W. D. Luedtke, R. G. Davis, D. W. Ishmael et al 21 Apr. 1964 46 p
(Contract NAS8-5434)
(NASA-CR-56468) OTS: $4.60 ph

This report on magnetic forming coil design and development covers the following: theory of the forming operations; metal forming; hammer and recoil problems; and application to the corrective realignment operation of Saturn. J.R.C.

N64-24054* General Electric Co., Cincinnati, Ohio Missile and Space Div.
DEVELOPMENT OF ELECTRICAL SWITCH GEAR FOR SPACE NUCLEAR ELECTRICAL SYSTEMS Quarterly Progress Report No. 3, 16 Jan.–16 Apr. 1964
R. N. Edwards, ed. [1964] 24 p
(Contract NAS3-2546)
(NASA-CR-54059) OTS: $2.60 ph

This document discusses the development of an electrical switchgear for space nuclear electrical systems in terms of program objectives, requirements and approaches, design, and testing—a.c. interruption, d.c. interruption, and contact weld. G.D.B.

N64-24059 Sprague Electric Co., North Adams, Mass.
PRODUCTION ENGINEERING MEASURE FOR COLUMBIUM CAPACITORS Second Quarterly Report, 26 Sep.–26 Dec. 1963
J. H. D. Folster, E. E. Holley, and A. Whitman Dec. 1963 11 p refs
(Contract DA-36-039-AMC-01468(E))
(AD-436536)

Study of aging conditions milder than those normally employed revealed that varying the voltage and temperature aging parameters apparently does not affect the final capacitance, dissipation factor, and leakage current readings on a capacitor; this finding resulted from a matrix study. The matrix also revealed that following aging bias-read and nonbias-read values of capacitance and dissipation factor are practically equal. The most recent data from the continuing reanodization studies indicate that multiple reanodizations improve the dissipation factors of 330μf-6V and 33μf-10 V capacitors. Author

N64-24067 Sperry Gyroscope Co., Great Neck, N.Y. Radiation Div.
DESIGN CRITERIA STUDY FOR HIGH POWER VOLTAGE RESEARCH FACILITY Second Quarterly Report, 1 Oct.–31 Dec. 1963
Jan. 1964 95 p refs
(Contract DA-36-039-AMC-03199(E))
(EB-5296-0359-2; AD-435883)

A survey was made of a number of possible uses of the facility including transmission lines, microwave components, lasers, and radiation weapons. A projection of technology for transmission lines for the 1967 to 1977 decade is also included. Power levels of the magnitude anticipated for this period indicate a radical departure from conventional transmission line. The use of high dielectric gases or vacuum will not be sufficient to achieve the required power using conventional waveguide. It presently appears that tall or square waveguide presents an interim solution. However, as research on circular waveguide advances and as power sources for TE_{01} circular electric mode becomes available, the many desirable features of circular guide will require its use. Delineation of the facility configuration was continued, and a description of the auxiliary equipment needed for the facility is included in this report. Analysis of the high-voltage power supply and high-power modulators was begun. Preliminary results are presented. Author

N64-24074 General Electric Co., Owensboro, Ky. Tube Dept.
X-BAND TUBE-AND-CAVITY-COMBINATION OSCILLATOR Final Report, 1 May 1961–30 Nov. 1963
J. M. Connelly and J. B. Quirk [1963] 66 p refs
(DA 36-039-AMC-02258(E))
(Rept.-10; AD-436858)

After a successful study of optimum triode integration into X-band circuitry and of high emission density oxide cathodes, triode oscillators for use at X-band (9.35 to 9.65 Gc) have been designed, built, and tested. Low overall power drain (less than 5 w) at a plate voltage of 150 v, light weight (less than 1 ounce), and simplicity of operation (single knob tuning) make them especially attractive when compared to more complicated existing devices. Successful 500-hr life performance has been demonstrated. In addition, experimental triodes capable of generating 2 w over the 9.3- to 9.6-Gc band have been demonstrated. Most of these have built-in resonators and adjustable grid-anode gaps that allow a CW-oscillator plate efficiency of 5% at X-band. Author

N64-24076 Sprague Electric Co., North Adams, Mass.
PRODUCTION ENGINEERING MEASURE FOR IMPROVED RELIABILITY OF SOLID ELECTROLYTE TANTALUM CAPACITORS
J. M. Eckfeldt and J. H. D. Folster [1963] 13 p
(DA-36-039-AMC-03621(E))
(QR-1; AD-437191)

A discussion of objectives and Sprague's approach to meeting them are in this report. Also provided is a description of progress to date, which includes an experimental matrix being run to determine the heat treatment effects on thin oxide films and the crystallization of these films at high temperatures, the starting of 10 experimental lots through the production process, and work toward the mechanization of the assembly operation. Seven of the experimental lots incorporate variations from the standard processing techniques, whereas the other three are processed in the standard manner and serve as controls. All the lots are to be tested following manufacture to determine the effect of the process variations. The work on the mechanization of the assembly operation involves the design and construction of seven different equipments. The design and preparation of drawings for five of these seven equipments are completed. Author

N64-24079 Case Inst. of Tech., Cleveland, Ohio Engineering Div.
TRANSMISSION ZERO SYNTHESIS USING CONGRUENCE TRANSFORMATIONS
John P. Stahl 28 Jan. 1964 65 p refs
(Contract Nonr-1141(10))
(TR-7; AD-436696)

The topic considered in this report is the use of a congruence transformation in the synthesis of a lossless 2-port coupling network loaded with a resistor. Both the transmission zeros and the open circuit natural frequencies of the network are prescribed. Because of the ease with which it may be synthesized, a resistance-terminated lossless ladder network is determined that has the prescribed open circuit natural frequencies, but that has all transmission zeros at infinity, and a congruence transformation that preserves these open circuit natural frequencies is then used to shift the transmission zeros from infinity to the locations specified. When the lossless part

of the original network is transformed by a real nonsingular transformation matrix, the transmission zeros of the transformed network may exist almost anywhere in the s plane but must have quadrantal symmetry. A method is presented that determines this matrix when the location of the new transmission zeros is specified, and it is shown that this matrix always exists. Transformerless networks are considered, and a set of conditions on the transformation matrix is formulated that must be satisfied if the transformed network is to exist without transformers. Author

N64-24093 Geotechnical Corp., Garland, Tex.
DEVELOPMENT OF LOW-POWER, LOW-NOISE PHOTOTUBE AMPLIFIER
James E. Keele 1 Aug. 1963 100 p
(TR-63-73; AD-435614)

This report describes the development of a low-power phototube amplifier having either analog or frequency modulated carrier output. Test results indicate the amplifier with either type output has the capability of detecting 1.25×10^{-18} w in the passband from 0.01 to 5 cps. The amplifier with analog output has a voltage gain of 350K, a total power requirement of 1.56 w, and a dynamic range of 60 db. The amplifier with frequency modulated carrier output has a power requirement of 1.8 w and when combined with FM discriminator, Model 15216, has a gain of approximately 700K and a dynamic range of 70 db. Author

N64-24095 United Aircraft Corp., Windsor Locks, Conn. Hamilton Standard Div.
ELECTRON BEAM TECHNIQUES FOR FABRICATION AND ASSEMBLY OF PARTS FOR ELECTRON TUBES Second Quarterly Report, Oct. 1–Dec. 31, 1963
J. F. Dudenhoefer [1964] 109 p refs
(Contract DA-36-039-AMC-03625(E))
(EBR-133; AD-435516)

The purposes of the program are outlined. The configurations welded and evaluated are tabulated along with the evaluation procedures and results. The results of the machining evaluation are presented. Progress in applying electron-beam processing to electron-tube fabrication is discussed. Author

N64-24096 Hughes Research Labs., Malibu, Calif. Material Sciences Lab.
ENHANCED BOMBARDMENT INDUCED CONDUCTIVITY STORAGE TARGET FOR MEMORY TUBES Interim Engineering Report, 4 Dec. 1963–31 Mar. 1964
N. H. Lehrer [1964] 29 p
(Contract AF 33(615)-1128)
(Rept.-1; AD-435968)

The primary objective of this work is to establish techniques for reading out the information stored in the sustained bombardment-induced conductivity (SEBIC) films. Electron-beam readout of the SEBIC layer was investigated. After several tests, the storage and readout of information for 30 min and longer was successfully accomplished using a modification of the high-energy electron-beam technique. With this technique, one defocused electron beam, about 500 V in energy, is used to hold the potential of one surface of the SEBIC layer. The equilibrium potential over the surface varies with the conductivity of the SEBIC layer, which has been modulated in accordance with the stored information. A 500 V readout beam scans the SEBIC layer, depositing charge corresponding to the modulations in the equilibrium potential. The stored information can be erased by momentarily removing the field, i.e., by turning off the holding beam. Author

N64-24107* New Mexico U., Albuquerque Engineering Experiment Station
THE MULTI-TERMINAL HALL GENERATOR
Sang S. Pak and W. W. Grannemann May 1964 62 p refs
(Grant NsG-279-62)
(NASA-CR-56568; EE-106) OTS: $6.00 ph

This thesis describes a study undertaken to maximize the Hall generator efficiency. A mathematical solution is obtained for a multiterminal Hall generator, and an analytical technique is developed for determining the optimum values of parameters to maximize the generator efficiency. An equivalent circuit is developed for an N output-terminal Hall generator, and the efficiency expression is obtained as a function of sample dimension, conductivity, and Hall coefficient of the material, and magnetic field strength. Some of the results have been checked experimentally with indium antimonide and fields up to 21.5 kilogauss. An efficiency of 40% was obtained experimentally for a 19-output-terminal Hall generator whereas for a 1-output-terminal efficiency was only 8%. To maximize the efficiency mobility, mobility ratio, magnetic field strength, and number of output-terminal pairs must be high, and impurity concentration must be low. The optimum load varies proportionally to the half power of N, the number of output pairs; and the optimum temperature is a function of magnetic field and sample dimensions. Author

N64-24134 Radio Corp. of America, Somerville, N.J. Semiconductor and Materials Div.
DEVELOPMENT OF HIGH CURRENT TUNNEL DIODES FOR STATIC INVERTERS Technical Documentary Report, 15 Apr. 1962–15 Jun. 1963
P. Gardner and F. Carlson Wright-Patterson AFB, Ohio., ASD, Aug. 1963 89 p refs
(Contract AF 33(657)-8964)
(ASD-TR-63-681; AD-414949)

Gallium arsenide tunnel diodes with peak current up to 900 amp at efficiencies greater than 60% have been fabricated. Gallium arsenide tunnel diodes with peak currents as high as 3,000 amp have also been fabricated, but with lower efficiencies. Germanium tunnel diodes with peak currents up to 300 amp and efficiencies as high as 55% have been built. Other germanium tunnel diodes with peak currents up to 500 amp at 48% efficiency have also been built. Gallium arsenide inverters providing output of 20 w have been operated with thermionic generators, and the feasibility of operating germanium tunnel diode inverters from thermoelectric generators has been demonstrated. Author

N64-24135 New York U., N.Y. Lab. for Electroscience Research
ON THE DOMINANT POLES OF THE DISTRIBUTED RC NETWORKS Ninth Scientific Report
John Kelly and Mohammed S. Ghausi Mar. 1964 47 p refs
(Contract AF 19(628)-379)
(AFCRL-64-288; TR-400-92; AD-601636)

A method is developed for determining the rise time, time delay, bandwidth, and phase shift of the voltage and current transfer functions of exponentially tapered distributed RC networks. An approximation technique is described that permits the location of the dominant poles of these distributed networks by means of a simple algebraic formula. The dominant poles are then used to determine the electrical characteristics of the network. Author

N64-24136 St. Josephs Coll., West Hartford, Conn.
PHOTOELECTRIC EFFECTS AT SEMICONDUCTOR ELECTRODES Final Report

Maria Clare Markham and Mahesh C. Upreti Jun. 1964 39 p refs
(Contract AF 19(628)-2768)
(AFCRL-64-362; AD-601633)

Zinc oxide, irradiated by near ultraviolet light in the absence of oxygen, operates as an efficient catalytic electrode for oxidation of organic compounds in aqueous solution, with a variety of oxidizing agents, including free oxygen, capable of serving as electron acceptors at a reference electrode. Attempts were made to sensitize zinc oxide to longer wavelengths. The emf produced depends on the nature of the electron acceptor. The actual operating photovoltages and/or photocurrents obtained depend on the following: (1) the presence of an oxidizable substrate at the irradiated zinc oxide surface; and (2) the nature and concentration of the electron acceptor at the dark electrode, as well as on the light intensity and the external load. E.C.

N64-24139 Sprague Electric Co., North Adams, Mass.
CHARACTERISTICS OF A SINGLE-CRYSTAL METAL BASE-TRANSISTOR
R. R. Garnache, J. J. Casey, and J. Lindmayer [1964] 7 p refs Presented at the 1964 Electron. Components Conf., Washington, May 1964
(TP-64-4)

This paper describes a metal-base transistor of single-crystal structure throughout in which the metal layer and the second semiconductor layer are deposited on a single-crystal substrate by epitaxial techniques. The properties of these new majority carrier devices with respect to voltage, current, power gain, frequency response, and radiation resistance are discussed. The important aspects of similarity and dissimilarity between the metal-base transistor and conventional transistors are pointed out, and theoretical justifications for these are given. Author

N64-24154 Army Engineer Research and Development Labs., Fort Belvoir, Va.
ON THE PROBLEM OF MEASURING BY MEANS OF ALTERNATING CURRENT THE DIFFERENTIAL CAPACITANCE OF ELECTRODES AND THE RESISTANCE OF ELECTROCHEMICAL REACTIONS
V. L. Kheyfets, A. B. Sheynin, B. Ya. Krasil'shchik, and Yu. V. Fisher [1961] 12 p refs Transl. into ENGLISH of a Russian Article
(T-1716; AD-434877)

Certain problems in determining differential capacitance of a double layer and the resistance of an electrochemical reaction with the aid of an a.c. are discussed. The values of the errors due to neglected or approximated resistance of the electrolyte are analyzed. A new method is proposed for measuring the capacitance of a double layer and the resistance of electrochemical reactions. G.D.B.

N64-24171 Cornell U., Ithaca, N.Y. School of Electrical Engineering
INVESTIGATION OF LINEAR BEAM AND NEW CONCEPTS OF MICROWAVE POWER GENERATION, VOLUME II. PART I: THEORETICAL AND EXPERIMENTAL CONSIDERATIONS OF THE DOUBLE-QUANTUM PHOTOELECTRIC EFFECT. PART II: GAIN EXPRESSIONS FOR BEAM-PLASMA INTERACTION
H. C. Bowers et al Griffiss AFB, N.Y., RADC, May 1964 109 p refs
(Contract AF 30(602)-3243)
(RADC-TDR-64-140, Vol. II; AD-601152)

A detailed analysis of the magnitude and time dependence of double-quantum photoelectric currents from metals irradiated by a modulation laser beam is carried out. Not all terms in the perturbation Hamiltonian contribute to the photoelectric current. Current densities for different metals with various Fermi levels and work functions are calculated, and it is shown that these currents should be large enough to be measured. Thermionic emission is also considered from a theoretical point of view. The surface temperature of a metal is derived as a function of time and light intensity for a modulated light beam and for a single pulse of light. From these results it is possible to estimate the thermionic emission due to an unfocused ruby laser beam and due to a focused gas laser beam. For the case of a focused ruby laser the model used in calculating the surface temperature is probably no longer valid. The experimental apparatus and circuitry used to study the above effects are described. Author

N64-24176 Harvard U., Cambridge, Mass. Gordon Mc Kay Lab.
PHYSICS OF FERROMAGNETIC AND FERROELECTRIC MATERIALS WITH APPLICATIONS TO MICROWAVE AND RADIOFREQUENCY CIRCUITRY Final Report, 1 Feb. 1959–30 Nov. 1963
R. V. Jones 29 Feb. 1964 39 p refs
(Contract AF 19(604)-5487)
(AFCRL-64-309; SR-9, Ser. 2; AD-600984)

Brief summaries of the following completed research projects are given: (1) Field Displacement Effects in Ferrited Loaded Waveguides, (2) Microwave Resonance in Ferromagnetic Systems at High Signal Levels, (3) Spin Wave Analysis of Ferromagnetic Resonance Relaxation, (4) Magnetic Anisotropy and Relaxation in Rare Earth Iron Garnets, (5) Specific Heat Measurements in Magnetic Oxide Systems, (6) Ferromagnetic Resonance under Large Hydrostatic Pressure, (7) Switching Properties of Ferrites and Garnets, (8) The Magnetic Properties of Gallium-Iron Oxide, and (9) High-Power Ferromagnetic Resonance in Magnetic Thin Film. D.S.G.

N64-24181 Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
MICROWAVE ACOUSTIC DELAY LINE AND RELATED ACTIVE DEVICES Second Quarterly Report, 17 Aug. 1963–16 Nov. 1963
F. Hickernell, W. Brendecke, and M. Medina Griffiss AFB, N.Y., RADC, Mar. 1964, 79 p
(Contract AF 30(602)-3076)
(RADC-TDR-64-22; AD-601566)

Primarily experimental efforts have produced 60-mc CdS amplifiers with 40-db net electrical gain and 120 db/cm gain values, with power output levels of 20 mw. Broadband, 60-mc, diffused surface transducers in CdS have been made with less than 12-db losses, and quartz transducer losses at 60 mc have been reduced below 3 db. Electrically tunable millihenry inductances with Q greater than 10 and Hall effect, nonreciprocal negative resistance circuits operating over a 30:1 frequency range are described along with methods for achieving low-temperature ohmic contacts to CdS crystals. These results represent major progress toward the objective of complex functional electronic circuits in single-crystal structures without discrete elements or interconnections. Author

N64-24189 New York U., N.Y. School of Eng. and Sci.
ON THE PROPERTIES OF COMBINATIONS OF PARAMETRIC ELEMENTS Tenth Scientific Report
Jacob Klapper and Mohammed S. Ghausi Mar. 1964 32 p refs
(Contract AF 19(628)-379)
(AFCRL-64-305; TR-400-93; AD-601132)

This paper discusses the properties of combinations of nonlinear elements, both resistive and reactive, under small signal conditions. A linear equivalent circuit and energy relations are derived for a circuit containing nonlinear resistance (NR), nonlinear capacitance (NC), and nonlinear inductance (NL), each pumped with an arbitrary phase angle. Such circuits exhibit a number of useful properties not found in circuits having only a single nonlinear element. Among them are the possibility of unilateralization over a frequency band, parametric amplification with lower frequency pumping and without using higher order nonlinearities, and converters with considerably more up-converter gain. The conditions for such operation are discussed. Author

N64-24193 Sylvania Electric Products, Inc., Mountain View, Calif.
INTERCEPT SYSTEM DYNAMIC RANGE ENHANCEMENT Final Technical Report
R. J. Powell, B. S. Golosman, H. Battjes, and T. Woods May 1964 161 p refs
(Contract AF 30(602)-2721)
(Rept.-64R13; RADC-TDR-64-83; AD-440298)

Because of their inherent capabilities, semiconductor-diode parametric devices are the subject of investigation. The large signal theory for parametric amplifiers and converters is thoroughly developed, and saturation mechanisms are investigated. The breakdown mechanism of saturation is investigated, and methods for extending the limits are presented and discussed. A theoretical analysis of intermodulation and cross modulation is presented, and methods of increasing linearity are discussed. Experimental devices built primarily to evaluate theoretical predictions from the MF range to S-band are described. The design details of a high dynamic range HF preselector are described, and the performance of this device is presented and discussed in some detail. Author

N64-24206 Philco Corp., Lansdale, Pa.
MICROMINIATURE PROGRAMMABLE LOGIC ELEMENTS Scientific Report No. 1
S. A. Idzik and L. M. Misewicz Apr. 1964 123 p refs
(Contract AF 19(628)-260)
(AFCRL-64-321; AD-601086)

The report is primarily concerned with the hardware phase of a program for research and development on microminiature programmable logic elements, which would constitute the digital section of a pattern recognition system called a Para-propagation Pattern Classifier (PPC). Study and design work at the beginning of the program resulted in the decision to use a modified DCTL system consisting of large numbers of a basic circuit configuration designated the basic cell (BC). Three subcell circuit types were selected for the BC configurations: a flip-flop (FF), a transfer gate (TG), and a residue gate (RG). The FF and TG were designed and fabricated as integrated silicon circuits; the RG as a tantalum–silicon hybrid. Detailed discussion of the hardware phase proceeds from the initial prototype circuits and covers the redesign, refinements, and fabrication process changes that evolved the final design circuits. Author

N64-24216 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
ULTRA-LOW-DRAIN LOCAL OSCILLATORS AND MIXERS FOR S–, C–, X–, AND KU-BAND USE
L. E. Scharmann Mar. 1964 10 p
(USAELRDL-TR-2438; AD-437186)

New methods are presented to accomplish local oscillator and mixer functions utilizing low-drain negative-grid tubes. Reduced total power input is emphasized. Design details and performance characteristics of oscillators, varactor multipliers, and harmonic detectors are given. Author

N64-24228 University of Southern Calif., Los Angeles School of Engineering
SOME STATISTICAL PROPERTIES OF ELECTROMAGNETIC NOISE
D. G. Childers and I. S. Reed Feb. 1964 41 p refs
(Contract AF 04(695)-304)
(USCEE-107; SSD-TDR-64-70; AD-437776)

The importance of designing a radar (or communications) receiver to operate effectively in the presence of spatial noise creates the necessity for developing a theoretical representation of the noise that can be used for the evaluation of various detection techniques. Such a representation for a general, polarized, nonisotropic noise process is formulated. This representation is used to determine the cross-spectral densities and cross-correlation functions between antenna array elements in the presence of the noise field only. Results for unpolarized noise are also obtained. Author

N64-24231 General Electric Co., Schenectady, N.Y. Advanced Technology Labs.
SPECTRAL FLASH LAMP Final Report
H. R. Koenig and W. E. Hill Mar. 1964 47 p refs
(Contract Nonr-4121(00); ARPA Order 306-62. Proj. Defender)
(AD-437572)

Spectral data were obtained from gallium–thallium iodide flash lamps. The lamps were 0.5-in. ID and 6 in. between electrodes; xenon was used as a fill gas. Spectral radiance in the broadened lines of gallium and thallium was found to saturate approximately at the level of a 10,000° K blackbody. Input power higher than the minimum required for saturation of line radiance resulted in higher radiance from continuum. Spectral data were obtained also from neon and xenon flash lamps of 0.5-in. diam and 6 in. between electrodes. Spectral radiance in the red band equal to a 20,000° K blackbody was readily obtained with 150μsec flashes in neon lamps, and spectral radiance equal to a 30,000° K blackbody was readily obtained with 50μsec flashes. Author

10 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands and wind tunnels); test ranges; and tracking stations. *For related information see:* 06 Auxiliary Systems.

N64-22870 Advisory Group for Aeronautical Research and Development, Paris (France)
PROCEEDINGS OF THE THIRTEENTH AGARD GENERAL ASSEMBLY [PROCES-VERBAL DE LA TREIZIEME ASSEMBLEE GENERALE DE L'AGARD]
[1963] 18 p refs Assembly Held at Athens, 10–12 Jul. 1963

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N64-22871 Hellenic National Defence General Staff, Athens (Greece)
THE NATO MISSILE FIRING INSTALLATION
M. Xenos *In AGARD* Proc. of the 13th AGARD Gen. Assembly [1963] p 27-35 (See N64-22870 16-10)

The NATO Missile Firing Installation (NAMFI) is being constructed in the Suda (Crete) area to satisfy a requirement for a range in Europe where NATO missile crews can hold their annual service firings. These live firings are designed to assist higher commands in determining the efficiency and effectiveness of their units with respect to operational readiness, deployment of equipment, and maintenance capabilities. A general description of the range, as well as the organization of NAMFI, is included. R.T.K.

N64-22873 Italy Ministero Difesa Aeronautica, Rome
THE MISSILE RANGE OF SALTO DI QUIRRA
Cesare de Porto *In AGARD* Proc. of the 13th AGARD Gen. Assembly [1963] p 51-59 (See N64-22870 16-10)

The mission of the Joint Test and Training Range of Salto di Quirra includes the planning and execution of missile flight tests and the testing activities for the full integration of the missile weapon system; in addition, the Range participates in and supports (Italian) national and international aerospace programs. A description is given of the operational and control structure of the Range missiles, safety, measurements, and communications organizations. R.T.K.

N64-22874 Gt. Brit. Ministry of Aviation, London
MISSILE RANGES—THEIR PURPOSE, DESIGN AND OPERATION
J. E. Serby *In AGARD* Proc. of the 13th AGARD Gen. Assembly [1963] p 61-75 (See N64-22870 16-10)

The building up of British and joint U.K.–Australian missile ranges is described. The ways in which the experience gained at these ranges can be applied to the new NATO range in Crete are discussed. The discussion is limited to the requirements for the practice firing of relatively short-range missiles. R.T.K.

N64-22875 Atlantic Missile Range, Athens (Greece)
THE ATLANTIC MISSILE RANGE
Leighton I. Davis *In* AGARD Proc. of the 13th AGARD Gen. Assembly [1963] p 77-89 (See N64-22870 16-10)

The Atlantic Missile Range is described. It extends from the east coast of Florida into the Indian Ocean. The short-range missiles are launched for a distance of about 1,500 miles. The ICBMs reach out to Ascension Island and beyond, for a distance of about 5,000 miles (or about 70° of the great circle arc on the earth's surface). Figures and photographs are presented of the Atlantic Missile Range, Cape Kennedy, the unloading of a Titan missile, the blockhouse, the takeoff of a U.S. Air Force Titan II, recording optical-tracking instrument camera inside dome, telemetry receiver with a 60-ft dish, and the H. H. Arnold instrumentation ship. R.T.K.

N64-22892 Naval Ordnance Lab., White Oak, Md.
DATA ACQUISITION AND RECORDING EQUIPMENT FOR THE NAVAL ORDNANCE LABORATORY'S HYPERSONIC TUNNEL NO. 8. DARE II
J. W. Willis Jun. 1964 19 p
(NOLTR-63-281; Aerodynamics Res.)
(Rept.-220; AD-601096)

This report describes the features and capabilities of DARE II, a 102-channel automatic analog-to-digital data system that is used in conjunction with the testing programs conducted at NOL. I.v.L.

N64-22903 David Taylor Model Basin, Washington, D.C. Hydromechanics Lab.
THE HIGH-SPEED BASIN AND INSTRUMENTATION AT THE DAVID TAYLOR MODEL BASIN
K. E. Schoenherr and W. F. Brownell Jan. 1963 30 p refs Presented at the ARS 17th Ann. Meeting, Los Angeles, 13 Nov. 1962
(DTMB-1660; AD-297122)

This paper describes the 2,968-ft high-speed basin and several instrumentation systems used for testing a wide variety of models such as full-scale torpedoes towed and self-propelled, hydrofoils, planing boats, pumpjets, propellers, and other high-speed vehicles. Information concerning the basin; towing carriages; and propulsion, force, and speed-measuring instrumentation is presented. Typical test procedures and usage of the carriages are discussed. New instrumentation nearing completion, which will greatly extend the high-speed basin testing capabilities, is described. Author

N64-22913 Aerospace Corp., El Segundo, Calif. Fluid Mechanics Dept.
HYPERSONIC WIND TUNNEL FACILITIES IN THE UNITED STATES
F. A. Vicente and Nancy S. Foy Mar. 1963 200 p refs
(Contract AF 04(695)-169)
(TOR-169(3305)-1; AD-405493)

A compilation of hypersonic wind-tunnel-facility data is presented, with particular attention being given to operating characteristics of the major hypersonic wind tunnels in the United States. A brief description is given of each facility, including information about responsible personnel, nozzle and test section, instrumentation, operational status, data-reduction method (when this has been available), running times, and particular test capabilities of each facility. An envelope of Reynolds number versus Mach number was drawn for each facility, with the use of a uniform scale. Envelopes of stagnation conditions were available in most cases and were also drawn on a uniform scale. The facilities appear in alphabetical order, but are indexed according to type of tunnel (i.e., continuous, hotshot, blowdown, or shock) and type of organizational management (i.e., government, industrial, university, and nonprofit corporations). D.E.W.

N64-22961 American Machine and Foundry Co., Niles, Ill. Mechanics Research Div.

INTERNAL ENVIRONMENTAL SIMULATOR FOR A MAN-MACHINE SYSTEM Final Report

J. D. Zeff, T. R. Charanian, D. A. Davidson, R. B. Neveril, and C. M. Tomsic Sep. 1963 83 p refs

(Contract N61339-786)

(NAVTRADEVCEN-786-2; AD-431026)

Control, maintenance, repair, and performance requirements for advanced life-support systems were investigated by laboratory evaluations of experimental water recovery, oxygen regeneration, and cabin gas conditioning models. This report reviews the design criteria, describes the system operation and test procedures, discusses the test results, and lists recommendations for an advanced, integrated life-support system. The three models were designed to support the physiological requirements for water, oxygen, and environmental control in a closed compartment containing a three-man crew on a two-week mission through a hostile external environment. The water recovery model yielded potable water at a rate of approximately 1 lb/hr with a recovery efficiency of 87.3%. Since the human body produces an excess of water yield over water consumption during a daily cycle, this unit is capable of supplying the closed cycle water requirements of three men when used with the cabin gas conditioning unit to recover condensed water vapor from the atmosphere. The oxygen regeneration unit reduced carbon dioxide at a rate of approximately 0.5 cu ft/min. Only short duration tests of the electrolysis subassembly were conducted, due to a dangerous pressure increase. The cabin gas conditioning unit maintained environmental conditions at 80° F, 50% relative humidity, and 1.5% carbon dioxide concentration. The temperature–humidity control unit performed acceptably, but the adsorption unit requires the incorporation of a predrier to obtain the desired rate of carbon dioxide adsorption of 2.55 cu ft/hr. Author

N64-23155 Martin Co., Orlando, Fla.

TRACK-VEHICLE MISSILE SYSTEM DYNAMIC ENVIRONMENT DATA ACQUISITION AND APPLICATION

R. Eustace *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 83–93 (See N64-23151 16-01)

This paper reports on the development of a road test program for a flexible system level track vehicle. In addition, typical data are presented for the Pershing missile on an XM474E2 track vehicle when subjected to endurance course conditions. A method of presentation of these data is shown that can provide, in a condensed format, an insight into the system response characteristics. The application of these data toward verification of the static and dynamic criteria is reviewed. Author

N64-23240 Federal Aviation Agency, Atlantic City, N.J. Evaluation Div.

EVALUATION OF INTERIM CONTROL PROCEDURES FOR PROPOSED ILS INSTALLATIONS AT KENNEDY AIRPORT ON RUNWAY 13L AND RUNWAY 13 AT LAGUARDIA AIRPORT Final Report

R. C. Conway Jun. 1964 52 p refs

(RD-64-87)

This report describes a simulation effort for the evaluation of interim control procedures that were developed to serve a proposed Instrument Landing System (ILS) installation on runway 13L at Kennedy International Airport and a proposed ILS installation on runway 13 at LaGuardia Airport without major revision to the total Metroplex. The simulation was conducted using the Model B Dynamic Air Traffic Control Simulator at the National Aviation Facilities Experimental Center, Atlantic City, New Jersey. Two plans were tested, using four different runway combinations, for the purpose of determining the more efficient procedures. Both plans are equally efficient as interim control procedures. It was recommended that consideration be given to using these interim procedures, or portions thereof as applicable, for the proposed ILS installations in the New York Metroplex. Author

N64-23671 Thompson (H. I.) Fiber Glass Co., Los Angeles, Calif.

PRESSURE DISTRIBUTION ON A 1/15 SCALE MODEL RADOME

W. H. Horton and B. H. Mc Quilkin Jan. 1964 65 p Prepared for Lincoln Lab., MIT

This report presents partial results of a series of tests made on model radome housing. The data presented and analyzed are the distribution of pressure on the model; a description of the test specimen is given; details of the tests are presented; and the results are given in graphical and tabular form. G.D.B.

N64-23719 Army Natick Labs., Mass.

EXPANDABLE FOAM-IN-PLACE SHELTERS AND RELATED ITEMS

Jack F. Furrer *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 397–399 (See N64-23701 16-01)

The design criteria are established for expandable foam-in-place shelters. One of the results of this study was a preliminary stress analysis of foam plastic shelters; the analysis is utilized to estimate the basic physical and mechanical parameters for various-sized shelters. J.R.C.

N64-23720 Army Natick Labs., Mass.

AIR-SUPPORTED TENTS FOR MILITARY USE

Constantin J. Monego *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 400–431 refs (See N64-23701 16-01)

The Army has shown 11 air-supported tents developed to meet specific operational requirements. The fabrics used are described, and the following problem areas are discussed: (1) Fabric coating compounds with improved flexibility at low temperature; (2) high-tenacity fibers with improved weathering characteristics; (3) studies of the dielectric constants on composite structures combining high-dielectric-constant materials with fibrous structures; and (4) studies on theoretical behavior of woven fabric subjected to biaxial stress. J.R.C.

N64-24155 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio Biophysics Lab.

NOISE SURVEY OF AUXILIARY SUPPORT EQUIPMENT AT ONE ATLAS COMPLEX AND ONE TITAN I COMPLEX, CAPE KENNEDY MISSILE TEST ANNEX, ATLANTIC MISSILE RANGE Technical Documentary Report, 8 Nov. 1961–31 Aug. 1962

Robert T. England Apr. 1964 33 p refs

(AMRL-TDR-64-31; AD-601809) OTS: $1.00

Noise-level measurements were made on several items of ground-support equipment at an Atlas complex and Titan I complex. Overall (from 18.7 to 9,600 cps) and octave-band (9 octaves within the overall range) sound pressure levels measured in the near vicinity of the equipment are presented. One-third octave-band sound pressure levels are also given for certain equipment that generates narrow-band sound levels. Exposure time limitations and speech interference levels for individuals working in the vicinity of the equipment are discussed. Recommendations are made for measures to be taken to insure against hearing loss and to improve the areas for speech effectiveness. Author

N64-24195 David Taylor Model Basin, Washington, D.C. Hydromechanics Lab.

FACILITIES AND RESEARCH CAPABILITIES, HIGH SPEED PHENOMENA DIVISION, DAVID TAYLOR MODEL BASIN, LANGLEY FIELD, VA. Research and Development Report

Roland E. Olson and William F. Brownell Apr. 1964 22 p refs

(DTMB-1809; AD-600955)

Information on physical characteristics of the basins, towing carriages, towing gear, model-handling equipment, instruments, and power supply is presented. A list of reports describing some of the past work in these facilities is included. Author

11 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; 13 Heat Transfer and Thermodynamics; and 24 Physics, Plasma.

N64-22746* National Aeronautics and Space Administration. Manned Spacecraft Center, Langley Station, Va.

A COMPARISON OF THE THEORETICAL AND EXPERIMENTAL STAGNATION-POINT HEAT TRANSFER IN AN ARC-HEATED SUBSONIC STREAM

Ronald D. Brown Washington, NASA, Jun. 1964 25 p refs

(NASA-TN-D-1927) OTS: $0.75

Stagnation-point heat-transfer measurements on flat-face cylinders of three different diameters in a 6-in. subsonic arc tunnel do not follow the laminar heat-transfer theory of Fay and Riddell for the Reynolds number range covered. It was concluded that the difference between theory and experiment was not a result of changes in velocity gradient associated with compressibility or channel-blocking effects. The deviation from laminar-flow theory is attributed to the free-stream turbulence in the test medium, which is caused by the a.c. electric arcs in arc chamber of subsonic arc tunnel. Author

N64-22911 Naval Ordnance Lab., White Oak, Md.

WEIGHT FLOW RATES THROUGH CIRCULAR HOLES IN A FLAT PLATE IMMERSED IN A SUBSONIC OR SUPERSONIC AIRSTREAM

C. A. Kalivretenos, A. P. Leonas, and N. P. Frandsen 8 Aug. 1963 18 p

(NOLTR-61-125; Aerodynamics Res. Rept.-162; AD-426097)

This report presents the results of an investigation conducted to measure the weight flow of air through various sized holes in a flat plate exposed to a flow parallel to the plane of the plate. These data were obtained at free-stream Mach 0.50 and 1.53 for various static pressure ratios across the flat plate. Author

N64-22956 Naval Research Lab., Washington, D.C. Mechanics Div.

A COMPARISON OF SHOCK AND ISENTROPIC HEATING IN LIGHT-GAS GUN COMPRESSION Interim Report

J. R. Baker 13 Apr. 1964 9 p refs

(NRL-6063; AD-600341)

An ideal model of light-gas gun operation that permits the evaluation of the effectiveness of shock heating in the light gas as opposed to the heating due to isentropic compression is hypothesized. This model assumes a shock wave generated by a piston that is instantly accelerated to some constant velocity. After the shock wave traverses the compression tube of the gun four times, it is followed by isentropic compression, which absorbs all of the piston energy. The temperatures arrived at by shock compression and isentropic compression are compared when the pressures of the final states are equal. The results indicate that for reasonably fast pistons (around 6,000 fps), the ideal temperature gains are on the order of 30% and the corresponding sound speed gains are only about 15%. The resulting increase in projectile velocity under these conditions cannot exceed 15%. Real gas effects would be expected to make this value still lower. It is concluded that shock heating is not an important factor in the gun operation nor a particularly fruitful means of enhancing gun performance. Author

N64-23032* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPARISONS OF EXPERIMENTAL FREE-JET BOUNDARIES WITH THEORETICAL RESULTS OBTAINED WITH THE METHOD OF CHARACTERISTICS

Allen R. Vick, Earl H. Andrews, Jr., John S. Dennard, and Charlotte B. Craidon Washington, NASA, Jun. 1964 105 p refs

(NASA-TN-D-2327) OTS: $2.50

The characteristics method is presented for computing highly underexpanded free-jet boundary contours. This procedure, permitting extension of the calculations to very high pressure ratios and large distances downstream of the nozzle exit, has been incorporated into a computer program that facilitates rapid calculations of jet exhaust characteristics. Computer programs written in FORTRAN language are presented for the leading characteristic line, corner expansion fan, and the characteristic network. An experimental investigation, undertaken to verify the theoretical procedure, consisted of obtaining schlieren photographs of unheated jet exhaust boundaries from nozzles having design exit Mach numbers of 1.0, 2.22, and 5.0. Author

N64-23073 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

APPLICATION OF POTENTIAL-FLOW SCHEME OF AN IDEAL FLUID TO CALCULATION OF AN AIRSTREAM WITH A REGION OF BACKFLOW

B. G. Khudenko (Moscow Aviation Inst.) *In its* Bull of Higher Educ. Inst. (Selected Articles) [1963] p 95–112 refs (See N64-23066)

The mathematical foundations for the infinite flow of an ideal gas for application to cavitational flow around a plate are used to compute the parameters of plane-parallel real-gas flow. It is found that the parameters of the flow can be calculated from the conditions of conservation of momentum flux, and that the total flow can be calculated by a series of successive approximations. D.E.R.

N64-23078 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

APPROXIMATE CONSTRUCTION OF STREAMLINES AROUND A GIVEN PROFILE IN A SUBSONIC STREAM WITH A LOCAL SUPERSONIC REGION TERMINATED BY A COMPRESSION SHOCK

I. N. Lanin (Kabardino-Balkar U.) *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 151–162 refs (See N64-23066 16-03)

Calculations are made of constructed streamlines around a given profile in a subsonic stream with a local supersonic region terminated by a compression shock. J.R.C.

N64-23084 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SUPPORTING STRUCTURES OF IRRIGATION CHANNELS AS OBJECTS OF CONTROL

Ya. T. Dub *In its* Automation 14 Feb. 1963 refs p 48–55 (See N64-23080 16-17)

The automation of water-level control in the large and small channels of irrigation systems using sluice gates is studied by electrohydrodynamic analogy. The most favorable condition for controlling the water level in the upper boundary of the structure is shown to correspond to the bypassing of maximum-delivery channels. The controlling conditions worsen with reduction in water delivery at the channels. At minimum water deliveries at the channel, the supporting structures can be considered as aperiodic links. M.P.G.

N64-23097 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

EMPLOYING THE KARMAN METHOD FOR CALCULATING A TURBULENT BOUNDARY LAYER ON A PLATE IN A GAS FLOW

L. G. Loytsanskiy and Yu. V. Lapin 13 Feb. 1963 14 p refs Transl. into ENGLISH from Tekhn. Gidromekhan., Politikonicheskiy Inst. (USSR), no. 217, 1961 p 7–16
(FTD-TT-62-1768/1+2; AD-400500)

In the theory of turbulent boundary layer in a compressible fluid at high velocities, two trends were noticed. This report shows how experiments at greater M-numbers offer evidence as to which trend is closer to the truth, the Frankl–Voyshl, or the Van Drast, both following the Kármán method. G.D.B.

N64-23101 Polytechnic Inst. of Brooklyn, N.Y.

ASYMPTOTIC FLOW PATTERN OF A HYPERSONIC BODY

Roberto Vaglio-Laurin Mar. 1964 62 p refs
(Grant AF-AFOSR-62-409)
(PIBAL-805; AD-600540)

A theoretical investigation of the steady, continuum, inviscid flow pattern at large distances downstream of finite hypersonic bodies is presented. Specifically, blunt-nosed plates and cylinders representative of actual bodies and associated wakes are considered. Asymptotic solutions are obtained for perfect gas flows at infinite Mach number. The following are shown: (1) The flows in question are not self-preserving (automodel). (2) An asymptotic description of the flows can be obtained by the method of matched expansions in conjunction with standard matching principles. (3) The asymptotic behavior of the bow shock is described by the law $y = a_0 x^m [1+a_1 x^{N1}+...]$ with the exponent $m=2/(3+\nu)$, in accord with the blast wave analogy, and with the exponent $N_1 = -m(1+\nu)(\gamma-1)/\gamma$, γ being the isentropic exponent of the gas. Considerations are qualitatively extended to the analysis of flows at large but finite Mach numbers; a general feature is the appearance of secondary trailing shocks for both two-dimensional and axisymmetric configurations. Author

N64-23144 Johns Hopkins U., Baltimore, Md.

CONCEPT OF FIELD MODES IN FLUID MECHANICS

Carl Kaplan Apr. 1964 58 p refs
(Contract AF 49(638)-496)
(AFOSR-SR-64-0719; AD-600964)

A new and novel method for studying the behavior of magnetohydrodynamic fields was used to explore steady incompressible two-dimensional linearized fluid flow with finite viscosity. This method, based on the central idea of splitting the behavior of a flow field into independent modes of behavior, is then applied to the often-treated and well-known case of viscous incompressible flow over a semiinfinite flat plate immersed in an unbounded uniform stream. Author

N64-23209 Aerodynamische Versuchsanstalt, Gottingen (W. Germany) Institut für Theoretische Aerodynamik

ON CONFORMAL TRANSFORMATION OF DESIRED PROFILES ON CYCLE AND DETERMINATION OF PRESSURE DISTRIBUTION IN TWO-DIMENSIONAL INCOMPRESSIBLE FLOW [ZUR KONFORMEN ABBILDUNG BELIEBIGER PROFILE AUF DEN KREIS UND BESTIMMUNG DER DRUCKVERTEILUNG IN EBENER INKOMPRESSIBLER STROMUNG]

F. Riegels and H. Wittich 21 Dec. 1942 17 p refs In GERMAN
(AVA-42-A-20)

The pressure distribution of arbitrary profiles with incompressible flow is treated with exact methods. From the known divergent Theodorsen process a purely numerical, practicable process is proposed that avoids intermediate mappings on circular figures. The exact identification of boundary points is defined with an iteration process. The velocity distribution can be determined by two different methods—by graphic or numerical derivation of the iterated exact identification of boundary points, or by avoiding this often inexact process. In order to prove the new methods, a limitation on symmetric profiles is provisionally adapted. Transl. by D.E.W.

N64-23271* National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

EFFECTS OF EXHAUST NOZZLE RECOMBINATION OF HYPERSONIC RAMJET PERFORMANCE. I. EXPERIMENTAL INVESTIGATION OF RECOMBINATION IN EXHAUST NOZZLES

Erwin R. Lezberg and Leo C. Franciscus N.Y., AIAA [1963] 11 p refs Presented at the AIAA-ASME Hypersonic Ramjet Conf., White Oak, Md., 23–25 Apr. 1963
(AIAA Paper-63-118)

Experimental temperature measurements have been made in supersonic nozzles with cone exit half-angles of 10.5° and 7°, for hydrogen–air and methane–air combustion products at stagnation temperatures up to 5,400° R and pressures up to 4.5 atm. The results indicate freezing in the vicinity of the nozzle throat. Comparisons of the data with an approximate freezing-point analysis and an exact calculation showed good

agreement with both. Preliminary spectral absorption measurements for the OH $^2\Sigma^+ - {}^2\Pi$ electronic transition were made by using the curve of growth to determine concentration and to demonstrate feasibility of spectroscopic concentration measurements. Author

N64-23291 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

OPTIMUM GEOMETRICAL RATIOS IN INDUCTION PUMPS FOR LIQUID METALS

N. M. Okhremenko 15 Feb. 1963 20 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 9, 1961 p 10–16

(FTD-TT-62-1724/1+2; AD-401325)

The problems encountered in obtaining the optimum construction of induction pumps by the conditions of maximum efficiency are considered. Two problems related to the selection of optimum geometric ratios in induction pumps are discussed: (1) judging the optimum ratios by maximum efficiency conditions, and (2) judging the optimum ratios by minimum weight conditions of all active materials. The solution to these problems is applied to a plain pump with a bilateral magnetic induction unit; the results are applicable to cylindrical and spiral pumps. R.T.K.

N64-23293 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE INFLUENCE OF LOSSES IN THE RUNNER ON THE EFFICIENCY OF A RADIAL-AXIAL TURBINE

A. Ye. Zaryankin and M. F. Zatsepin 4 Feb. 1963 12 p refs Transl. into ENGLISH from Izvest. Vyssh. Ucheb. Zaved., Energ. (Minsk), no. 4, 1962 p 79–84

(FTD-TT-62-1801/1+2+4; AD-299672)

The efficiency of a turbine stage is determined to a considerable degree by the aerodynamic properties of the runner; little experimental data on the influence of the runner on the efficiency of a radial–axial turbine is available. This report examines certain theoretical considerations and experimental data to establish the extent of the effect of the loss coefficient and the role of the curvature of the runner outlet edges on the efficiency of a radial–axial turbine. G.D.B.

N64-23314 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

EMF OF THERMOCOUPLES COMPRESSED BY A SHOCK-WAVE

V. S. Plyukhin and V. N. Kologrivov 11 Dec. 1963 9 p refs Trans. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 5, 1962 p 175–176

(FTD-TT-63-1057/1+2; AD-426901)

When a shock wave goes through a substance, it is subjected to quick adiabatic compression and becomes heated. If a shock wave passes through the dividing surface between two metals that give a thermoelectric effect, then EMF should be produced mainly as a result of heating. The effect of the pressure on the magnitude of the EMF is not great. Measuring the temperature of a substance compressed by a shock wave through the extent of the EMF produced is possible; such an attempt was made and is discussed in this report. G.D.B.

N64-23355* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

EFFECT OF BOUNDARY LAYER TRANSITION ON DYNAMIC STABILITY OVER LARGE AMPLITUDES OF OSCILLATION

Peter Jaffe and Robert H. Prislin N.Y., AIAA [1964] 16 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964

(Contract NAS7-100)

(AIAA Paper-64-427) AIAA: $0.50 members, $1.00 nonmembers

Extensive free-flight dynamic stability measurements of 10° half-angle cones with laminar and tripped boundary layers at supersonic speeds are presented. Free-flight measurements showing the effects of Mach number, center-of-gravity position, and angle-of-attack oscillatory amplitude on dynamic stability are also presented. The measurements were obtained by launching 1-in.-diam models at controlled angles-of-attack up to 40° into the oncoming wind-tunnel flow with a low-velocity pneumatic gun. This motion and the corresponding flow patterns were recorded with high-speed motion pictures taken through the schlieren system. Because of the low model Reynolds number in the wind tunnel, it was necessary to artificially induce boundary-layer transition with wire rings. The free-flight results show that dynamic stability is not perceptibly affected by the state of the boundary layer, but is affected by the amplitude of oscillation. The data are compared with Tobak's potential flow solution and a solution using the Newtonian impact theory at all angles-of-attack. Free-flight drag and stability results are also included. Author

N64-23374* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN EXPERIMENTAL INVESTIGATION OF HIGHLY UNDEREXPANDED FREE JETS IMPINGING UPON A PARALLEL FLAT SURFACE

Allen R. Vick and Earl H. Andrews, Jr. Washington, NASA, Jun. 1964 59 p refs

(NASA-TN-D-2326) OTS: $1.50

The experimental test program consisted of obtaining pressure measurements and high-speed schlieren photographs. Unheated air of approximately 2,400 lb/sq in. abs was exhausted from two different nozzles, a converging nozzle (jet Mach number, 1.0) and a converging-diverging nozzle (jet Mach number, 5.0). The jet-impingement surface was mounted parallel to the nozzle axial center line, and the distance of this surface away from the nozzle axis was a variable for each of the test nozzles. Data are presented over a range of ratios of jet total pressure to ambient pressure varying from about 250,000 down to 50,000 ft. Author

N64-23382 Boeing Co., Seattle, Wash.

TWO DIMENSIONAL OR AXIALLY SYMMETRIC REAL GAS FLOWS BY THE METHOD OF CHARACTERISTICS. PART II, FLOW FIELDS AROUND BODIES

D. W. Eastman 10 Jul. 1963 34 p refs

(D2-10598)

This document presents a summary of results from a digital computer program for calculating inviscid supersonic flow fields around two-dimensional bodies or axisymmetric bodies at zero angle-of-attack. This program, based on the method of characteristics, can be used for either perfect or real gas in thermodynamic equilibrium and can calculate flow fields around bodies with flares or concave curvature. Results are presented for both sharp- and blunt-nosed bodies in perfect and real gas. Whenever possible, they have been compared with experimental data. Author

N64-23400 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

AC-ELECTRIC ARC INSTALLATION FOR THE OBTAINMENT OF HIGH TEMPERATURE GAS FLOW

V. S. Pelevin 13 Feb. 1963 10 p refs Transl. into ENGLISH From Inzh.-Fiz. Zh. (USSR), no. 12, 1961 p 32–36 (FTD-TT-62-1753/1+2; AD-401731)

The nature of the phenomena taking place in an electric arc are explained. The way in which a high-temperature gas flow is obtained by using this arc is described. The construction of the arc and its operational parameters are presented. R.T.K.

N64-23401 Defense Research Corp., Santa Barbara, Calif. Aerospace Operations Dept.

INTENSIFICATION OF TURBULENCE BY CHEMICAL HEAT RELEASE

Alan Q. Eschenroeder Aug. 1963 30 p refs

(Contract DA-04-495-ORD-3567(Z); ARPA Order 347-63)

(TR63-217D; AD-423791)

Volumetric chemical energy release is studied as a mechanism for enhancing the isotropic turbulent motion of a compressible fluid medium. Both the vortical and dilatational components are examined to determine the influence of irreversible heat addition from exothermic reactions. To a first-order approximation, the density fluctuations caused by eddy production and destruction are shown to be insensitive to the behavior of internal degrees of freedom in the gas (including chemistry). Based on this finding, the pressure fluctuations are determined from a linearized analysis of the combined chemical and gasdynamic response to density fluctuations. The results for amplitudes and phase relationship between pressure and density fluctuations are used to obtain an estimate of the power delivered. Author

N64-23441 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON BASE PRESSURE FOR SOLIDS OF REVOLUTION IN A SUPERSONIC GAS FLOW

L. I. Vereshchagina 10 Jan. 1964 9 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Mat., Mekhan. i Astron., no. 13, 1963 p 139–143

(FTD-TT-63-1146/1+2; AD-430217)

The theory of mixing was used to explain the base pressure for solids of revolution in a supersonic gas flow. In the computation of the bottom temperature in a laminar or a turbulent mixing, the flow's speed and zone must be accounted for. The investigation of the flow is concerned primarily with boundary layers, expansion, and the stagnation zone. A.L.B.

N64-23472 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A METHOD OF PROJECTING, AND THE RESULTS OF INVESTIGATING A VANELESS DEFLECTOR FOR RADIAL-AXIAL TURBINES

A. V. Gubarev et al *In its* News of Schools of Higher Education Aeronautical Engineering 1 Mar. 1963 p 10–23 (See N64-23470 16-01)

The method of calculating the vaneless deflector enables the definition necessary to determine the geometric parameters necessary to solve the converse problem. Results obtained show the need for careful preparation of the helix, since, when the geometry deviates from that calculated, the field of velocities entering the turbine wheel is distorted. J.R.C.

N64-23473 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CHARACTERISTIC THROTTLING FEATURES OF SINGLE-SHAFT BYPASS TURBOJET ENGINES IN DIFFERENT CONTROL PROGRAMS

A. L. Klyachkin and A. G. Smirnov *In its* News of Schools of Higher Education Aeronautical Engineering 1 Mar. 1963 p 24–40 refs (See N64-23470 16-01)

Discussion of the effect of the control programs on throttling features of single-shaft bypass turbojet engines covers the following: the course of flow lines in the work regime of compressors of the first and second stage, the change in parameters in the function of bypass and straight turbojet engines in choking, the change in the individual parameters of the bypass and straight turbojet engine when throttled, and the throttling characteristics of the bypass turbojet engine in flight. J.R.C.

N64-23481 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE INFLUENCE OF PRANDTL NUMBER VARIABILITY ON THE FLOW IN THE VICINITY OF CRITICAL POINT OF AN OBTUSE BODY AT SMALL REYNOLDS NUMBERS

I. N. Murzinov *In its* Journal of Applied Mechanics and Technical Physics 25 Feb. 1963 p 8–15 refs (See N64-23479 16-24)

Equilibrium flow of a viscous gas in the vicinity of the forward part of an axially symmetrical obtuse body moving at supersonic velocity is discussed. The gas is assumed to be rarefied, so that it is necessary to take the viscous forces into consideration over the entire zone of flow between body and shock wave. Results of calculating the influence of the Prandtl number, wall temperature, and Reynolds number on the heat exchange at critical points are given. P.V.E.

N64-23489 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

OPTIMUM DIFFUSER SHAPE

I. Ye. Virozub and A. Sh. Dorfman *In its* Heat Power Engineering 14 Feb. 1963 p 20–32 refs (See N64-23487 16-01)

The variational problem of the shape of a diffuser with minimum losses has been examined. The optimum is a diffuser consisting of a part close to the conical and an abrupt expansion on exit. The results obtained agree qualitatively with the published experimental data on flat diffusers. Author

N64-23490 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

NOMOGRAMS FOR THE APPROXIMATE CALCULATION OF PROFILE FLOW IN TURBINE GRILLS

G. Ya. Shnitser *In its* Heat Power Engineering 14 Feb. 1963 p 33–39 refs (See N64-23487 16-01)

Nomograms, based on modified equations used by A. N. Sherstyuk, to calculate the distribution of velocities on the profile perimeter of turbine grid vanes based on simple solutions for the flow of an incompressible fluid in curvilinear channels are presented in this paper. E.C.

N64-23498 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CALCULATION OF VARIABLE REGIMES OF CASCADE FLOW

V. A. Zysin *In its* Power Machine Construct. 4 Mar. 1963 p 69–80 refs (See N64-23494 16-01)

It is proposed that a generalized diagram, similar in structure to the ordinary i-S diagram, be used to calculate the variable regimes of turbine cascade operation. The method is for calculating general regularities. All processes are schematized, use is made of stream theory, and the velocity and flow factors are assumed to be identical. Ejection, leakages, etc. are not taken into account. P.V.E.

N64-23558 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE FORCED VIBRATIONS OF A RECIPROCATING HYDRAULIC SERVO WITHOUT FEEDBACK

Yu. Ye. Zakharov and V. U. Barauóv *In its* Mech. 28 Aug. 1963 p 116–133 refs (See N64-23551 16-01)

This is part of a cycle of investigations of hydromechanical processes taking place in the slide valves of hydraulic mechanisms. Results were successfully applied to the design of hydraulic vibrators for the automatic crushing of chips in the process of machining articles on metal-cutting lathes. A.W.

N64-23563 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

GENERAL EQUATIONS OF MOTION OF A RIGID BODY WITH LIQUID-FILLED CAVITIES, AND THE GENERALIZATION OF ONE THEOREM DUE TO N. E. ZHUKOVSKIY

I. S. Chikina *In its* Mech. 28 Aug. 1963 p 189–221 ref (See N64-23551 16-01)

The usefulness of tensor and vector methods in the solution of problems of dynamics of a rigid body with liquid filled cavities is discussed. A new expression, which is mathematically more simple, is obtained for Zhukovskiy's result that characterizes the change of kinetic energy of the entire mechanical system in the process of the system's motion. The method of derivation proceeds from general theorems of dynamics of a system of particles to the particular case where the body contains a cavity entirely filled with a viscous incompressible liquid. M.P.G.

N64-23564 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

VIBRATIONS OF VISCOUS LIQUIDS CONTAINED IN A CYLINDRICALLY SHAPED CAVITY, WHICH IS IN A STATE OF HORIZONTAL MOTION

I. S. Chikina *In its* Mech. 28 Aug. 1963 p 222–231 refs (See N64-23551 16-01)

The motions of a viscous liquid that has a free surface and is contained in a cylinder with its axis in horizontal position are studied, assuming that the center of gravity of the cylinder moves horizontally with a constant acceleration. Solutions are derived showing that the period of the vibrations of the viscous fluid will be greater than for an ideal fluid, and that the waves impinging upon the surface are displaced in the direction of motion of the body in comparison with the waves in an ideal liquid. M.P.G.

N64-23590 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

INVESTIGATION OF DYNAMIC CHARACTERISTICS OF TEMPERATURE SENSORS FOR A RETARDED AIR FLOW

G. P. Stepanov and Yu. N. Kulikov *In its* Autom. Control of Aircraft Eng. 7 Nov. 1963 p 3–36 refs (See N64-23589 16-01)

The analytical method of determining dynamic errors of temperature sensors is examined, and the results of theoretical calculations are compared with experimental data. A method is set forth for determining the time constant of the temperature measurement sensor required. The calculated values of time constants, for specific types of temperature sensors, are compared with time-constant values determined experimentally. G.D.B.

N64-23600 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE VELOCITY OF SOUND AND HUGONIOT'S ADIABATE FOR PARTIALLY IONIZED HEAVY INERT GASES

A. Szaniawski *In its* Record of Appl. Mech. 30 Aug. 1963 p 32–54 (See N64-23597 16-01)

Increase in gas temperature causes changes in the atomic structure. The electrons spinning around the nucleus pass from lower energy orbits to higher energy orbits, so as to eventually detach themselves from the nucleus at sufficiently high temperatures. In order to simplify the mathematical analysis of this phenomenon, a simplified model of an ionizable monoatomic gas (or a dissociated polyatomic gas) is introduced. Thermodynamic equations are developed using the model, and the compatibility of the equations with physical principles is investigated. The velocity of sound in such a gas is calculated along with Hugoniot's adiabate. (Hugoniot's adiabate is calculated by considering the Rankine–Hugoniot conditions for a strong shock wave causing the ionization of an initially cold gas.) P.V.E.

N64-23612* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

SOME EFFECTS OF GAS STRATIFICATION ON CHOKED NOZZLE FLOWS

J. R. Wrobel N.Y., AIAA [1964] 9 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964 (Contract NAS7-100)

(AIAA Paper-64-266) AIAA: $0.50 members, $1.00 nonmembers

The influence of the difference in properties of the constituents of a stratified multicomponent ideal gas on the flow through a nozzle is investigated analytically. The characteristic velocity c^* and the specific impulse I_s are computed and compared with values appropriate to the cases of thoroughly mixed gas constituents and equilibrium flow. These predictions are compared with the results of an approximate method by using average properties to illustrate the validity of the approximate method. The limited comparison presented indicates that the approximate method is virtually exact in predicting the c^* and I_s values appropriate to stratified flow, provided that the specific heat ratios of the constituent gases are nearly equal. The assumption of thoroughly mixed gases yields results that lie between the stratified-flow predictions and the equilibrium-flow predictions for the examples studied. Author

N64-23616 California U., Livermore Lawrence Radiation Lab.

VORTEX TUBES, A BIBLIOGRAPHY

Brigitta M. Dobratz Apr. 1964 24 p refs (Contract W-7405-ENG-48)

(UCRL-7829) OTS: $0.50

N64-23651 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

JOURNAL OF APPLIED MECHANICS AND TECHNICAL PHYSICS (SELECTED ARTICLES)

21 Jan. 1964 57 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (USSR), no. 2, 1963 p 3–20, 154–158, 169–172

(FTD-TT-63-839/1+2+4)

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3. THE STRUCTURE OF A FLAME FRONT A. S. Pleshanov p 47–54 refs (See N64-23654 16–11)

N64-23652 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CERTAIN PROBLEMS OF THE HYDRODYNAMICS OF RELAXING MEDIA

I. P. Stakhanov and Ye. V. Stupochenko *In its* Journal of Appl. Mech. and Tech. Phys. 21 Jan. 1964 p 1–35 refs (See N64-23651 16-11)

Certain general properties of the equations of motion of media that are in a state of thermodynamic nonequilibrium and the transition to "equilibrium" hydrodynamics, in the limiting case of small relaxation times, are examined. Also certain problems of the propagation of small disturbances in a relaxing media are examined by a linear approximation. I.v.L.

N64-23653 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE BREAKUP OF DROPS AND A FLUID STREAM BY AN AIR SHOCK WAVE

A. A. Buzukov *In its* Journal of Appl. Mech. and Tech. Phys. 21 Jan. 1964 p 36–46 refs (See N64-23651 16-11)

The results of an experimental study of the supercritical breakup of droplets and streams of water by an air shock wave are presented. Also, a study of the qualitative picture of the breakup is described, and certain empirically verified formulas for breakup time are proposed. A value was found for the critical relationship between the governing parameters at which the aforementioned supercritical mechanism of disintegration begins. I.v.L.

N64-23654 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE STRUCTURE OF A FLAME FRONT

A. S. Pleshanov *In its* Journal of Appl. Mech. and Tech. Phys. 21 Jan. 1964 p 47–54 ref (See N64-23651 16-11)

Solutions of hydrodynamic equations with respect to chemical reactions were found in the first two approximations from the square of the Mach number (M^2). In the stationary case, the pressure in the flame front, which varies proportionately to M^2, increases when $P > 1$ or decreases when $P < 1$ (P is the Prandtl number). For the nonstationary case, qualitative distributions of temperature, pressure, density, and velocity are given with respect to the flow. I.v.L.

N64-23677 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

HYPERSONIC FLOW PAST SLENDER BLUNT ELLIPTIC CONES

A. A. Bogacheva and M. D. Ladyzhenskiy *In its* Eng. J. 23 Mar. 1964 p 1–10 refs (See N64-23676 16-01)

Hypersonic flow past slender blunt elliptic cones is considered on the assumption of an infinitely compressed gas in the shock wave. The problem is reduced to the numerical solution of an ordinary third-order differential equation. The results of calculations for various cones with different semiaxis ratio are presented. These results can be used in the qualitative analysis of hypersonic flow past triangular airfoils having a very small aspect ratio and a blunt nose. Author

N64-23678 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

LAMINAR BOUNDRY LAYER WITH REACTION FRONT ON A POROUS PLATE

V. M. Yemel'yanov *In its* Eng. J. 23 Mar. 1964 p 11–18 refs (See N64-23676 16-01)

The problem is considered of the steady flow of a hot or high speed compressible gas past a semiinfinite plate through which a gas coolant that reacts in the boundary layer with the oncoming gas is injected according to the law $V_w = x^{1/2}$. The reaction takes place at an infinitely fast rate and at a definite temperature. The reaction is represented as taking place on a surface of discontinuity of the boundary layer (the reaction surface) whose position is determined by the temperature of the reaction. E.W.

N64-23679 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

DEVELOPMENT OF PLANE-PARALLEL BOUNDARY LAYER IN THE NEIGHBORHOOD OF THE CRITICAL POINT OF A BLUNT BODY, SET IN MOTION IMPULSIVELY

Ye. M. Shakhov *In its* Eng. J. 23 Mar. 1964 p 19–29 refs (See N64-23676 16–01)

The present paper has as its object the analysis of the boundary-layer development during any interval of time, up to steady-state conditions; the investigation is confined to the vicinity of the front point of a blunt body, where the separation of the boundary layer does not affect appreciably the flow past the body. This problem was solved previously by means of a momentum-integral relation. The method of investigation of the present paper is based on the direct utilization of the differential equations of an unsteady boundary layer. An approximate solution of the problem is sought in the form of an exact solution of some differential equation, which approximates the system of differential equations of the unsteady boundary layer with given initial and boundary conditions. This solution proves to be fairly close to the exact solution of the problem. A more refined calculation of boundary layer development is then performed by the method of successive approximations with the use of the third approximation for the initial stage of the process, and with the obtained approximate solution for the asymptotic behavior of the solution. Author

N64-23680 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE NATURE OF FLOW IN THE STAGNATION REGION

V. Ya. Neyland and G. I. Taganov *In its* Eng. J. 23 Mar. 1964 p 30–38 refs (See N64-23676 16-01)

It is assumed that there exist solutions for a stagnation cone with reverse flow for the range of stagnation cone angles from minimum value to $\pi/2$. Solutions for a continuous range of stagnation region angles are given for two-dimensional and axisymmetric supersonic flows past a body. The maximum angle of the stagnation region for both two-dimensional and axisymmetric flow does not exceed the limit angle value permitting the existence of an attached shock. E.W.

N64-23682 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE BEHAVIOR OF HEATED PLATES AND SLOPING SHELLS IN A GAS FLOW

V. V. Bolotin *In its* Eng. J. 23 Mar. 1964 p 97–56 refs (See N64-23676 16-01)

The object of this paper is to ascertain the behavior of skin panels under actual conditions. Data relating to the flight conditions of the rocket V-2 (A-4) are used. It is found that thermal buckling predominates. In other cases, an alternation of thermal buckling and flutter is possible. Author

N64-23683 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE EQUATION OF THREE VELOCITIES FOR A SHOCK TUBE
A. I. Lashkov *In its* Eng. J. 23 Mar. 1964 p 57–59 refs (See N64-23676 16-01)

The equation connecting the three principal velocities of gas flow in a shock tube is derived. The relation can be used to find limit values of the parameters of flow for the reflected shock wave. E.W.

N64-23684 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
JOURNAL OF APPLIED MECHANICS AND TECHNICAL PHYSICS (SELECTED ARTICLES)
10 Sep. 1963 41 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekan. Fiz. (Moscow), no. 4, Jul.–Aug. 1962 p 21–26, 94–99, 117–119
(FTD-TT-63-87/1+2; AD-421192)

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2. EXPERIMENTAL INVESTIGATIONS OF SPINNING DETONATION BY MEANS OF PIEZOELECTRIC GAUGES M. Y. Topchiyan p 18–32 refs (See N64-23687 16–13)

3. TURBULENT BOUNDARY LAYER ON A PLANE PLATE G. L. Grodzovskiy p 33–38 refs (See N64-23687 16–11)

N64-23685 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DIFFUSIVE-THERMAL STABILITY OF LAMINAR FLAME
G. I. Barenblatt, Ya. B. Zel'dovich, and A. G. Istratov *In its* J. of Appl. Mech. and Tech. Phys. 10 Sep. 1963 p 1–17 refs (See N64-23684 16-11)

An analysis was made of the thermoconductance and diffusion equation in a medium moving with a constant velocity from left to right, parallel to the X-axis. Calculations were made by the usual method of small perturbations. G.D.B.

N64-23687 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TURBULENT BOUNDARY LAYER ON A PLANE PLATE
G. L. Grodzovskiy *In its* J. of Appl. Mech. and Tech. Phys. 10 Sep. 1963 p 33–38 refs (See N64-23684 16-11)

A number of known equations for calculating the drag coefficient of skin friction Cf on a plate were derived, on the basis of Prandtl's logarithm theory for determining the profile velocity "u" in the boundary layer, and were in good agreement with test results in the tunnel. In the case of a flat plate, the logarithmic profile does not coincide with the experimental contour in the external portion of the boundary layer. To determine the profile contour in the vicinity of the boundary, a method used in the solution of freestream vorticity problems is applied. G.D.B.

N64-23810 Harry Diamond Labs., Washington, D.C.
PROCEEDINGS OF THE FLUID AMPLIFICATION SYMPOSIUM, VOLUME II
[1964] 483 p refs Symp. Held 26–28 May 1964
(AD-602001)

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12. MULTIPLE-BALL PNEUMATIC AMPLIFIERS J. J. Eige (Stanford Research Inst.) p 273–288 (See N64-23822 16–11)

13. THE STAGING OF PRESSURE PROPORTIONAL AMPLIFIERS TO PROVIDE STABLE MEDIUM GAIN, DUAL CONTROL, SINGLE OUTPUT PURE FLUID SYSTEMS W. L. Cochran and R. W. Van Tilburg (Corning Glass Works) p 289–312 refs (See N64-23823 16–11)

14. DEVELOPMENT OF A PROPORTIONAL FLUID AMPLIFIER FOR MULTI-STAGE OPERATION R. W. Van Tilburg and W. L. Cochran (Corning Glass Works) p 313–334 (See N64-23824 16–11)

15. EXPERIMENTS IN ANALOG COMPUTATION WITH FLUIDS S. Katz, J. M. Goto, and R. J. Dockery, (Harry Diamond Labs.) p 355–374 (See N64-23825 16–11)

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17. FEASIBILITY STUDY OF A FLUID AMPLIFIER STEAM TURBINE SPEED CONTROL W. A. Boothe (General Electric Co.) p 377–404 refs (See N64-23826 16–11)

18. APPLICATIONS OF PURE FLUID TECHNIQUES TO A SPEED CONTROL J. R. Colston and E. M. Dexter (Bowles Engineering Corp.) p 405–430 refs (See N64-23827 16–11)

19. A PURE FLUID HYDROFOIL CONTROL SYSTEM R. E. Bowles and E. U. Sower, III (Bowles Engineering Corp.) p 431–458 refs (See N64-23828 16–11)

20. A STATUS REPORT ON THE EXPERIMENTAL DEVELOPMENT OF A HOT GAS VALVE J. C. Dunaway and V. H. Ayre (Army Missile Command, Huntsville, Alabama) p 459–480 (See N64-23829 16–11)

21. DEVELOPMENT OF TWO PURE FLUID TIMERS G. V. Lemmon (Sandia Corp.) and E. R. Phillips (Sperry Rand Corp.) p 481–496 (See N64-23830 16–11)

N64-23811 Johnson Service Co., Milwaukee, Wis. Research and Development Div.
THE IMPACT MODULATOR

Bjorn G. Bjornsen *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 5–32 refs (See N64-23810 16-11)
(Contract DA-49-186-AMC-28(X))

The paper explains how the familiar mechanical motion-balance concept has been applied to the design of a new basic pure fluid component called the Impact Modulator. The design versions called the Transverse Impact Modulator and the Direct Impact Modulator are discussed in regard to pressure and flow gains. The output signals can be above and/or below standard atmosphere; i.e., positive and/or negative output flows and pressures are possible. The DIM incorporates a unique input signal method, which not only can accept positive and/or negative signals in the above sense, but also has a very high input impedance, approaching infinity, which increases its sensitivity and reduces several loading problems. These are exemplified by the cascading of two DIMs yielding a pressure gain of approximately 8000:1 and a starting input pressure of 0.00125 psig. Author

N64-23812 Johnson Service Co., Milwaukee, Wis. Research and Development Div.
SOME PROPERTIES AND APPLICATIONS OF DIRECT AND TRANSVERSE IMPACT MODULATORS
T. J. Lechner and P. H. Sorenson *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 33–60 refs (See N64-23810 16-11)
(Contract DA-49-186-AMC-28(X))

Some of the properties and applications of unique pure fluid amplifying element, called the impact modulator, are described. A discussion of the operating principles of the two types of modulators (direct and transverse) is given. The compatibility characteristics of these modulators, such as output impedance, transfer curves, etc., are presented. These characteristics are used to construct a four-stage amplifier with a 12,000:1 pressure grain. This amplifier is used to form the forward loop of a pure fluid operational amplifier. The performance characteristics, such as gain, linearity, offset, etc., of this amplifier are discussed, and suggestions for its improvement are given. I.v.L.

N64-23813 Bendix Corp., Southfield, Mich. Bendix Research Labs.
CONTROL CHARACTERISTICS OF VORTEX VALVES
Endre A. Mayer and Paul Maker *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 61–84 refs (See N64-23810 16-11)

A plane vortex has two velocity components, a radial component and a tangential component. The interaction between these components may be used to accomplish a valving function, using no moving mechanical elements other than the fluid flows. This feature makes the vortex valve a desirable control element in the output stages of fluid power systems. Author

N64-23814 Marquardt Corp., Van Nuys, Calif.
EXPERIMENTAL STUDY OF A PROPORTIONAL VORTEX FLUID AMPLIFIER
Ben A. Otsap *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 85–124 refs (See N64-23810 16-11)
(Contracts AF 33(657)-12146; AF 33(616)-40809)

An experimental investigation was conducted on a vortex-controlled proportional fluid amplifier exhibiting unique characteristics of high pressure gain of 200, high pressure recovery, fast response, and high signal-to-noise ratio. The performance characteristics were investigated, analyzed, and are presented in terms of nondimensional quantities and nondimensional design parameters. The adaptation of the high pressure gain of a fluid amplifier to network application is presented. An approach to staging and circuit application is presented with suggested notation and schematization. Performance comparison to pressure controlled and momentum controlled fluid amplifiers is presented utilizing nondimensional parameters. Author

N64-23815 United Aircraft Corp., East Hartford, Conn. Research Labs.
CHARACTERISTICS OF A VORTEX FLUID THROTTLE
David P. Miller *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 125–146 refs (See N64-23810 16-11)

Experimental studies were conducted to determine performance characteristics of a fluid throttle in which secondary air is injected upstream of the nozzle throat tangentially to the wall so as to produce a vortex in the converging section. Data are presented showing static pressure at the wall and pitot pressure along the centerline of the cylindrical chamber ahead of the nozzle as a function of injectant total pressure. The effect of the number and area of the injection ports and of the injection Mach number on the throttling effectiveness of the vortex throttle is also presented. The data are compared with an approximate inviscid theory for swirling flow through a nozzle and its applicability to predicting vortex throttle performance is discussed. Finally, the data for the vortex throttle are compared with the data for a fluid throttle in which air was injected into the throat of a similar nozzle from a circular annulus radially and upstream at angles of 60 and 45 deg relative to the direction of flow. Author

N64-23816 Nebraska U., Lincoln
CHARACTERISTICS OF COUNTER-VORTEX OSCILLATORS
Turgut Sarpkaya *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 147–162 refs (See N64-23810 16-11)

The characteristics of the vortex motion created by two vortices rotating in opposite directions in an axially symmetrical vortex tube are investigated. The median pressures, the amplitude, and the frequency of the pressure oscillations at the two vortex chambers were determined. It is found that only the unique combinations of pressure at the two vortex chambers produce oscillations of constant amplitude and frequency. The initial vortex motion, while irrotational immediately after entry into the vortex tube, does not stay irrotational, but transforms itself partly to rotational flow as it proceeds along the connecting tube. The change from one flow to the other is due to viscosity. The amplitude of the pressure oscillations increases with decreasing lengths of the connecting tube while the inverse is true for the frequency. The characteristics of the counter-vortex motion are strongly dependent on the ratio of the tangential velocity to the axial velocity at the jet origin. When this ratio is sufficiently large, the axial velocity reverses its direction near the jet axis. Author

N64-23817 Franklin Inst., Philadelphia, Pa.
APPLICATION TECHNIQUES FOR PROPORTIONAL PURE FLUID AMPLIFIERS
C. A. Belsterling and K. C. Tsui *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 163–190 (See N64-23810 16-11)
(Sponsored by the Army)

The ultimate objective of this research program is to promote the application of pure fluid devices in systems, by describing those devices in terms familiar to the control systems engineer. It is intended to define static and dynamic

analogies of network parameters, equivalent electrical circuits, and transfer functions; and to develop analytical and graphical techniques for more direct system analysis. To date, load line techniques and equivalent circuits for both static and dynamic cases have been developed. Experimental tests have verified some aspects of the approach. Author

N64-23818 International Business Machines Corp., New York, N.Y. General Products Div.
STATIC DESIGN OF PNEUMATIC LOGIC CIRCUITS
H. T. Saghafi *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 191–220 refs (See N64-23810 16-11)

This paper describes the static design of pneumatic logic circuits using jet amplifiers. The design approach is presented in the graphical form for better visualization of circuit operations. Basically, the concern is with a generalized logic circuit that is modified to build resistor and diode AND and OR blocks. Initially, two algebraic circuit equations are derived for the output network of this generalized block. Then, the existence of a focus point for the switching points (a useful property of the input network) is demonstrated. Finally, the graphical design approach of several resistor and diode logic circuits is presented. The result of the analysis is the qualitative determination of an overall relationship between fan-in, instability distance, switch points, and input impedance of the attachment amplifier. From these relationships a theoretically ideal input characteristic was evolved that would result in circuit design flexibility as well as maximum fan-in for a given instability region. Logical properties of the mono-output and duo-output fluid jet amplifiers are also discussed in terms of several possible pneumatic logic systems. Author

N64-23819 Marquardt Corp., Van Nuys, Calif.
APPLICATION OF PURE FLUID LOGIC TO ON-OFF CONTROL SYSTEMS
D. J. Nelson and H. Iwata *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 221–242 refs (See N64-23810 16-11)
(Contract AF 33(657)-12146)

Digital techniques are broadly classified into arithmetic and pure logic. Many control problems can be solved by using the latter technique. Since, in general, there are alternative ways of representing the same Boolean function, the pure-logic decoding network can usually be simplified. Methods are outlined by which this can be done. In many applications, the output decoding can be restricted to two states that implies piecewise linear or on–off control. This technique was applied to a pure fluid control system. The resulting minimal logic circuit and exploratory systems synthesis are presented. Author

N64-23820 Telecomputing Corp., San Diego, Calif. Whittaker Controls and Guidance Div.
THEORETICAL ANALYSIS OF FLUID AMPLIFIER DESIGN
R. E. Denker *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 243–260 refs (See N64-23810 16-11)

This paper develops a formula that interrelates the major factors involved in a pneumatic bistable amplifier that operates above critical pressure ratios. The formula enables accurate scaling of a design and indicates the direction required for optimization. The analysis is based upon techniques that are used in the missile components industry for design of submerged pneumatic flow systems. Author

N64-23821 Fluid Logic Control Systems, New York, N.Y.
THE TURBULENCE AMPLIFIER IN CONTROL SYSTEMS
Raymond N. Auger *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 261–272 refs (See N64-23810 16-11)

The turbulence amplifier is a high-gain, very low pressure, low-cost pneumatic amplifier with no moving parts. It can be used as the primary switching and sensing device in many control systems, which might use or presently use electonic relays, photocells, limit switches, or transistor logic modules. The components of the amplifier are mentioned, and specific examples of application are given. I.v.L.

N64-23822 Stanford Research Inst., Menlo Park, Calif. Control Systems Lab.
MULTIPLE-BALL PNEUMATIC AMPLIFIERS
John J. Eige *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 273–288 (See N64-23810 16-11)

A new class of fluid amplifier was devised in which a balance of forces on balls of two sizes valves air-pressure signals. The few simple parts allow high input flow resistance, low output resistance, low power dissipation, visual indication of state, and compatibility with a variety of outputs including bellows, nozzles, and electrical contacts. Two balls form a logical inhibitor, and three balls comprise a two-input NOR, either element being sufficient to combine in networks for all binary logic functions. A wide range of size and pressure level is possible. Units have been made as small as 0.04 $in.^3$ per NOR with interconnections. Power consumption of 10 mw and switching times of 1.7 msec were measured. Ball diameters of from 1/16 to 3/8 in. are representative. Supply pressures have ranged from 0.1 to 100 psig. The two-ball element can also be combined with flow restrictors to act as an operational amplifier for analog summing and integrating. All-solid parts of a variety of materials can tolerate high temperature and hard radiation. Author

N64-23823 Corning Glass Works, N.Y.
THE STAGING OF PRESSURE PROPORTIONAL AMPLIFIERS TO PROVIDE STABLE, MEDIUM GAIN, DUAL CONTROL, SINGLE OUTPUT PURE FLUID SYSTEMS
W. L. Cochran and R. W. Van Tilburg *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 289–312 refs (See N64-23810 16-11)

Fabrication and testing techniques used in the development of multistage pressure-proportional amplifier pure-fluid systems are discussed, and practical solutions to some of the problems inherent in the development of interconnected fluid subsystems are given where available. Performance of individual elements are discussed as they relate to staged system performance. Staged system noise and individual element noise is described, and the attempts to locate and eliminate the sources of the noise are discussed. In each case only those solutions that have been demonstrated as possible and practical are offered. A solution to the problem of providing a common power inlet to a multistaged system is presented, and the effect of using such a common source is discussed. The description and output characteristics of a modified passive difference amplifier are given. Author

N64-23824 Corning Glass Works, N.Y.
DEVELOPMENT OF A PROPORTIONAL FLUID AMPLIFIER FOR MULTI STAGE OPERATION
R. W. Van Tilburg and W. L. Cochran *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 313–334 (See N64-23810 16-11)

A presentation is made of the data and general information obtained during the development of a basic proportional device for use in fabrication of a multistage, high-gain proportional amplifier. Starting with a sound basic design of a pressure gain device, a comprehensive study was undertaken, directed toward maximizing the pressure gain while maintaining operating conditions that would permit direct in-line coupling of several identical devices. All design and operational parameters that were felt to have a direct effect on pressure gain were investigated, with primary emphasis on aspect ratio, control edge width, size, and the relationship between power jet pressure and control jet pressure. The program was basically empirical in nature, utilizing the optical fabrication techniques developed to permit fabrication of pure fluid components and systems in Fotoform glass and Fotoceram glass ceramics.
Author

N64-23825 Harry Diamond Labs., Washington, D.C.
EXPERIMENTS IN ANALOG COMPUTATION WITH FLUIDS
Silas Katz, John M. Goto, and Robert J. Dockery *In its* Proc. of the Fluid Amplification Symp., Vol. II [1964] p 335–374 refs (See N64-23810 16-11)

A study is made of the use of passive and active fluid components without mechanical moving parts to perform analog computations. The active fluid component is the proportional fluid amplifier with feedback. Multiplication by a constant greater than unity and integration are demonstrated. The errors in computation are considered with a view toward designing better components.
Author

N64-23826 General Electric Co., Schenectady, N.Y. Advanced Technology Labs.
FEASIBILITY STUDY OF A FLUID AMPLIFIER STEAM TURBINE SPEED CONTROL
W. A. Boothe *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 377–404 refs (See N64-23810 16-11)
(Contract Nonr-4001(00))

This paper describes a study of the feasibility of applying fluid amplifiers to the control of a steam turbine. The study included an extensive computer analysis to determine the relative merits of all-analog, all-digital, or hybrid analog/digital operation. Circuit requirements to meet the more rigid Specification MIL-G-21410 were determined. Using fluid amplifier elements, it appears feasible to get performance equivalent to that now obtained by electrohydraulic speed controls. A description is given of a working demonstrator using tuned reed speed references. The demonstrator consists of a small air turbine with a pneumatic drag-brake load. In this circuit there are no moving parts other than the turbine and the tuned reeds.
Author

N64-23827 Bowles Engineering Corp., Silver Spring, Md.
APPLICATIONS OF PURE FLUID TECHNIQUES TO A SPEED CONTROL
J. R. Colston and E. M. Dexter *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 405–430 (See N64-23810 16-11)

This report is concerned with a 500-kw powerplant using steam for the control and for the bearings, thus completely eliminating the need for electromechanical devices and a second fluid.
I.v.L.

N64-23828 Bowles Engineering Corp., Silver Spring, Md.
A PURE FLUID HYDROFOIL CONTROL SYSTEM
Ronald E. Bowles and Edwin U. Sowers, III *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 431–458 refs (See N64-23810 16-11)

This report deals with the design and testing of a scaled, submerged foil, fluid control model. Results indicate the following: (1) This control system is responsive to the environment of changing velocity and to the angle-of-attack common to wave motion. (2) Such a hydrofoil lift control system would be effective in controlling the vertical acceleration forces on a hydrofoil craft under actual sea conditions. (3) The mathematical model derived to represent the system was sound, hence, the procedure presented may be used with confidence in the design of future systems.
I.v.L.

N64-23829 Army Missile Command, Huntsville, Ala. Army Inertial Guidance and Control Lab.
A STATUS REPORT ON THE EXPERIMENTAL DEVELOPMENT OF A HOT GAS VALVE
J. C. Dunaway and V. H. Ayre *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 459–480 (See N64-23810 16-11)

This report describes an effort toward development of a hot gas jet reaction valve utilizing boundary-layer technique to control a high pressure, high-temperature gas stream. The result of this program to date was the successful design of a hot gas valve in a reaction control system using fluid-controlled bistable amplifier principles, requiring no moving parts in the gas stream and no source of secondary pressure. Valves have been fabricated and successfully tested with gases at pressures to 1,300 psi and temperatures to 2,350° F with flow rates to 1#/sec cold air.
Author

N64-23830 Sandia Corp., Albuquerque, N. Mex.
DEVELOPMENT OF TWO PURE FLUID TIMERS
G. V. Lemmon and E. R. Phillips (Sperry Rand Corp) *In* Harry Diamond Labs. Proc. of the Fluid Amplification Symp., Vol. II [1964] p 481–496 (See N64-23810 16-11)

Two pure fluid timers are discussed. One timer contains 100 identical NOR gates plus one monostable toggle device in the clock. The second timer contained 84 NOR gates plus the clock. Both timers worked immediately upon assembly (except for one minor logic error in the first timer) and required no timing or adjustments of any kind. With a reliable element having adequate fan-in and fan-out characteristics, very complex logic networks can be designed and built with ease using pure fluid devices. The elements used in the two timers were produced by a casting technique and were 100% tested before assembly.
I.v.L.

N64-23890 Los Alamos Scientific Lab., N. Mex.
THE TWO-DIMENSIONAL HYDRODYNAMIC HOT SPOT
Charles L. Mader 9 Jun. 1964 84 p refs
(Contract W-7405-ENG-36)
(LA-3077) OTS: $2.00

The basic processes in the shock initiation of inhomogeneous explosives are theoretically investigated, using the model of a cylinder of nitromethane containing a spherical void. The interaction of a shock with a spherical void, the resulting formation of a hot spot, and buildup to propagating detonation have been computed, using two-dimensional numerical hydrodynamics of the PIC (particle-in-cell) type with chemical reaction and realistic equations of state.
Author

N64-23891 McGill U., Montreal (Canada) Mechanical Engineering Research Labs.
JETS AND WALL JETS IN UNIFORM STREAMING FLOW
I. S. Gartshore 4 May 1964 84 p refs
(Grant DRB-9551-12)
(Rept.-64-4)

A half-momentum integral technique is used to analyze a jet and a wall jet in uniform streaming flow. A wall jet is described as a jet of fluid emitted tangentially to a solid surface. The nondimensionalized eddy viscosity varies with distance along the flow, for both a wall jet and free jet in uniform streaming flow, and this variation is attributed to lateral rate of strain acting on the largest eddies of the flow. Intermittency measurements in the two-dimensional free jet and wall jet are presented. Values of the standard deviation of the laminar superlayer from its mean position may be found from the intermittency results in each case, and are interpreted as a statistical measurement of the largest eddy size. Measurements of the mean velocities in four wall jets with four different values of external streaming flow velocity are presented. The constants necessary for the theory are evaluated from two of these cases, and a comparison between calculated and measured values is made for the remaining two cases. P.V.E.

N64-23941* Lockheed-California Co., Burbank

[ASSEMBLY OF VARIOUS NUMERICAL SOLUTIONS TO FLUID DYNAMIC PROBLEMS, PROGRAMMING OF THE SOLUTIONS, AND COMPUTER CHECKOUT OF THE PROGRAMS] Third Monthly Progress Report, 1 Aug.–31 Aug. 1963

John L. Benson [1963] 4 p refs
(Contract NAS2-1460)
(NASA-CR-56370) OTS: $1.10 ph

Various numerical solutions to fluid dynamic problems were found. These solutions were programed for and checked out on a computer. Routines for shock intersection and vortex sheet computation for an ideal gas were assembled. The real-gas solution for the above was initiated along with the routines for shock-boundary-layer interactions, shock-vortex intersection, and transition. Programing of the external isentropic compression surface routine and the laminar boundary-layer routine was completed. R.T.K.

N64-23968 California Inst. of Tech., Pasadena

ULTRASONIC MODEL STUDY OF ELASTIC WAVES IN LAYERED MEDIA Final Report

M. Nafi Toksöz 15 May 1964 7 p refs
(Contract DA-ARO(D)-31-124-G216)
(AROD-1740-11; AD-441349)

Results of various seismic model projects, including the seismic model laboratory, are described. The technique of making plates anisotropic was introduced. Construction of two-dimensional models is discussed. Attenuation of seismic waves in solids was considered. G.D.B.

N64-23988 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

FLUCTUATING WALL PRESSURE UNDER A SEPARATED SUPERSONIC FLOW

A. L. Kistler Mar. 1964 7 p refs Repr. from the J. of the Acoust. Soc. of Am., v. 36, no. 3, Mar. 1964 p 543–550
(Contract NAS7-100)
(NASA-CR-56564; JPL-TR-32-505)

Measurements have been obtained of the pressure fluctuations under the turbulent, separated region ahead of a forward-facing step at Mach 3.01 and 4.54. These pressures are significantly larger than the pressures produced by an attached boundary layer. The data can be interpreted as showing that the pressure fluctuations originate from two distinct causes—fluctuations due to changes in the geometry of the separated region and fluctuations due to the turbulent, free shear layer. The levels to be expected from each cause can be estimated from a simple model. Author

N64-23998* Lockheed Aircraft Corp., Sunnyvale, Calif.

[MATHEMATICAL ANALYSIS FOR THE BOUNDARY LAYER OF AN INVISCID FLOW USING AN IBM COMPUTER PROGRAM] Sixth Monthly Progress Report, Nov. 1963

[1963] 16 p refs
(Contract NAS2-1460)
(NASA-CR-56368) OTS: $1.60 ph

Efforts included assembling the various subroutines into one complete program. Integrating of the boundary-layer solution with the characteristic solution was also accomplished. G.D.B.

N64-24004 France. Office National Detudes et de Recherches Aeronautiques, Chatillon-Sous-Bagneux

THE EXPERIMENTAL DETERMINATION OF MOBILE HYDRODYNAMIC FORCES DUE TO THE WAVE-MOVEMENT OF PROPULSION LIQUIDS [LA DETERMINATION EXPERIMENTALE DES FORCES HYDRODYNAMIQUES INSTATIONNAIRES DUES AU CLAPOTIS DES LIQUIDES DE PROPULSION]

Christian Béatrix [1964] 30 p refs Presented at the Meeting of the Groupe Materiaux et Structures de L'AGARD, Liege, France, 27 May–2 Jun. 1964 In FRENCH
(ONERA-TP-136)

The generation of nonstationary hydrodynamic forces provoked by the sloshing of liquid propellants in the fuel tanks of missiles can influence their behavior in flight. Since theoretical studies are inadequate for resolving part of the problem, experimental methods were developed, and studies were carried out on this type of engine. The conclusions are useful in the selection of proper arrangements for minimizing the effect of sloshing and in the comparison of the effects of liquids having different properties. M.P.G.

N64-24060 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (W. Germany)

A METHOD FOR THE CALCULATION OF FLOW RATE, JET SUCTION MAGNITUDE AS WELL AS VELOCITY DISTRIBUTION ON THE CONTOUR OF MODERATELY THICK PROPELLER-TYPE NOZZLES [EIN VERFAHREN ZUR BERECHNUNG DER DURCHFLUSSZAHL, DER DUSENSOGZIFFER SOWIE DER GESCHWINDIGKEITSVERTEILUNG AND DER KONTUR MASSIG DICKER DUSENSCHRAUBEN]

L. Bollheimer (Tech. Hochschule Karlsruhe) Mar. 1964 61 p refs In GERMAN
(DVL-277)

This report takes into consideration the effect of nozzle-profile thickness. Integral equations are derived for the maximum flow distribution and vortices distribution of a propeller-type nozzle, and the circulation distribution at the rear of the nozzle is determined. These equations are advantageous in that they can be solved by the Weissinger method for ordinary ring nozzles and his numerical tables can be used. In addition, with the aid of these equations, formulas are derived for determining the magnitudes of the following: (1) the tangential velocity at the nozzle contour; (2) the flow rate; and (3) jet suction. The appendix contains numerical tables and some simple examples pertaining to propeller-type nozzles with a nozzle length-to-diameter ratio of 0.5. I.v.L.

N64-24072 Aeronautical Systems Div., Wright-Patterson AFB, Ohio

SUMMARY OF LAMINAR FLOW CONTROL TECHNIQUES FOR AIRCRAFT

Philip P. Antonatos, Joseph P. Nenni, and Roland X. Mueller Sep. 1963 40 p refs Presented at the ASD 1963 Sci. and Eng. Symp., Wright-Patterson AFB, Ohio, 18–19 Sep. 1963 (ASD-TDR-63-689; AD-434841)

From the first aerodynamic investigations that proved the existence of a viscous layer of fluid over a wing surface, it was shown that the penalty in terms of skin friction drag and resulting power requirements for cruise was a high percentage of the total drag of an aircraft. Efficient means were sought for reducing the magnitude of this drag by at least preventing turbulent flow conditions from existing on the wing surfaces. With the advent of the jet engine it became possible to efficiently provide a means of suction to control the boundary layer on the surfaces that would offer practically no weight penalty. Further research showed the feasibility of using fine slots versus a distributed suction technique. As a result, a program to modify the entire wing assembly of a B-66 was initiated to incorporate this new principle and prove the practical feasibility of laminar flow control. Design considerations of this application are reviewed. Author

N64-24098 David Taylor Model Basin, Washington, D.C. Structural Mechanics Lab.
ON THE THEORY OF STABILITY OF A PROLATE SPHEROIDAL SHELL UNDER UNIFORM EXTERNAL PRESSURE [K TEORII USTOICHIVOSTI VYTYANUTOI ELLIPSOIDAL'NOI OBOLOCHKI VRASHCHENIYA PRI VNESHNEM RAVNOMERNOM DAVLENII]
R. G. Surkin Jan. 1964 22 p refs Transl. into ENGLISH from Izv. Kazansk. Filiala Akad. Nauk SSSR, Ser. Fiz.-Mat. i Tekhn. Nauk, no. 7, 1955
(DTMB-TRANS-317; AD-435607)

The Rayleigh–Ritz method is used to solve the problem of stability of prolate spheroidal shells under uniform external pressure. Nonlinear terms are retained in the analysis. The "equal energy" load and the minimum postbuckling load are determined for several cases that demonstrate the effect of varying the eccentricity of the generating ellipse. Author

N64-24118* Lockheed-California Co., Burbank
SEVENTH MONTHLY PROGRESS REPORT, 12–31 DECEMBER 1963
[1963] 12 p refs
(Contract NAS2-1460)
(NASA-CR-56367) OTS: $1.60 ph

Continuation of the checkout of the combined viscous–inviscid program, improving numerical techniques in the characteristic program, and programing of the classical turbulent boundary-layer solution for frozen flow are described. E.K.R.

N64-24127 United Aircraft Corp., East Hartford, Conn. Research labs.
CALCULATIONS OF HYPERSONIC DYNAMIC STABILITY Quarterly Status Report No. 2, 29 Feb.–28 May 1964
Martin R. Fink and James B. Carroll Jun. 1964 48 p refs
(Contract NOw-64-0092-f)
(C910188-8; AD-442280)

A method for calculating hypersonic static and dynamic stability coefficients of sharp-nosed axisymmetric bodies and wing–fuselage combinations is described. Computed effects of nose bluntness on static and dynamic stability coefficients of cones are presented and discussed. Computed effects of airfoil shape, Mach number, and angle-of-attack on the stability coefficients of isolated wings are presented. Author

N64-24143 Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
PRESSURE MEASUREMENTS FOR MACH 8 FLOWS OVER EXPANSION CORNERS AND RAMP ON AN INTERNALLY COOLED MODEL. PART III: FLOWS OVER FULL SPAN RAMPS MOUNTED ON A FLAT PLATE
Louis G. Kaufman, II Wright-Patterson AFB, Ohio, Res. and Technol. Div., May 1964 158 p refs
(Contract AF 33(616)-8130)
(RTD-TDR-63-4044, PT. III, AD-601805)

Pressure and heat-transfer data were obtained for Mach 8 flows over a blunt pyramidal configuration composed of a 70° sweepback delta-wing surface and two dihedral surfaces. Trailing-edge flap deflections were varied up to 40° on all surfaces, and the model was tested with and without canards and ventral fins. The model was pitched at angles-of-attack between ±54° and was tested at sideslip angles of 0° and 12° for free-stream Reynolds numbers, based on model length of 1.5 and 4.5 million. Author

N64-24144 Academia Republicii Populare Romine, Bucharest (Rumania) Institute of Applied Mechanics "Traian Vuia"
ANNIVERSARY SCIENTIFIC SESSION [SESIUNEA STIINTIFICA JUBILIARA]
E. Carafoli [1963] 446 p refs Session Held at Bucharest, 4–7 Jul. 1960 In RUMANIAN

This volume contains general lectures and reports, as well as abstracts of papers on general mechanics, mechanics of deformable media, and fluid mechanics. Papers dealing with theoretical mechanics and computing methods, theory of mechanisms and machines, and friction and wear in machines are presented in the general mechanics section. Elasticity, plasticity, strength of materials, vibrations in machines and industrial buildings, statics and dynamics of structures, and machining of metals and tilling of soil are grouped in the mechanics of deformable media section. Under fluid mechanics are papers on theoretical and applied hydrodynamics, theoretical and applied aerodynamics and gasdynamics, and hydrodynamic–aerodynamic lubrication in the construction of machines. N.E.A.

N64-24147* National Bureau of Standards, Boulder, Colo.
FUNCTIONS FOR THE CACULATION OF ENTROPY, ENTHALPY, AND INTERNAL ENERGY FOR REAL FLUIDS USING EQUATIONS OF STATE AND SPECIFIC HEATS
J. G. Hust and A. L. Gosman New York, Plenum Press, 1964 Repr. from Advan. in Cryogenic Eng. v. 9, p 226–233 refs Presented at the 1963 Cryogenic Eng. Conf., Colorado U., Boulder
(NASA Order R-45)

Functions are derived for calculation of entropy, enthalpy, and internal energy for real fluids by using equations of state and specific heats. The general thermodynamic relations are presented for the calculation of thermodynamic properties from functions representing pressure, volume, temperature, specific heat, velocity of sound, or Toule–Thomson data. The equations are developed in terms of zero pressure and are applied to a particular equation of state. J.R.C.

N64-24160* Princeton U., N.J. Guggenheim Labs. for the Aerospace Propulsion Sciences
BUBBLE MOTION STUDIES FOR THE LIQUID CORE NUCLEAR ROCKET
J. F. Lieberherr and Peter M. Williams 31 Dec. 1963 64 p refs
(Grant NsG-389)
(NASA-CR-56229; Aeronautical Eng. Rept.-672) OTS: $6.60 ph

Pertinent areas of study in relation to the liquid-core nuclear rocket are the flow and heat-transfer characteristics of multibubble streams in which the bubbles are not necessarily spherical. Techniques for the measurement of three-dimensional velocities of single- and multiple-bubble streams of nitrogen in room-temperature water were developed. The relation between vertical and horizontal velocities in the critical region was investigated. No information of direct application to the liquid-core nuclear rocket has evolved, but the fundamental uncertainties in the bubble regimes of interest to the liquid-core nuclear rocket have been defined. E.C.

N64-24204 Nottingham U. (Gt. Brit.)
A NEW METHOD FOR STUDYING SELF-DIFFUSION IN LIQUIDS: SELF-DIFFUSION IN LIQUID MERCURY Technical Note No. 1
D. S. Brown and D. G. Tuck 1 Mar. 1964 16 p refs
(Grant AF EOAR 62-53)
(ARL-64-114; AD-601037)

A new technique has been developed for measuring the self-diffusion coefficients of liquids. Inactive and labeled samples of the liquid are contacted in a long capillary cell, and the extent of diffusion at suitable time intervals is determined by means of a collimated scintillation counter. Experimental details and possible errors are discussed. The method has been tested with liquid mercury, for which, over the temperature range 23° to 60° C, is found $D = 1.10 \times 10^{-4} e^{-1150/RT}$ $cm^2 sec^{-1}$. This result agrees with the work of Nachtrieb and Petit, but is significantly lower than measurements by the capillary cell technique. Possible reasons for this are discussed. Author

12 GEOPHYSICS

Includes auroral phenomena; upper atmosphere studies; oceanography; cartography; geodesy; and geomagnetism. *For Van Allen belts see*: 28 Space Radiation. *For related information see*: 05 Astronomy and Astrophysics; 21 Meteorology; and 29 Space Sciences.

N64-22726 Joint Publications Research Service, Washington, D.C.
DETERMINATION OF INTERPOLATION ERRORS OF ASTRONOMICAL-GEODETICAL DEFLECTIONS OF THE VERTICAL IN WESTERN CZECHOSLOVAKIA
Milan Bursa 19 May 1964 18 p refs Transl. into ENGLISH from Geofiz. SB. (Prague), v. 10, 1963 p 11–23
(JPRS-24666; OTS-64-31289) OTS: $0.50

Results of error investigations indicate the following: (1) The root mean square error of linear interpolation of the astronomic–geodetic deflection of the vertical components in a given region amounts to about ±2.5 inches, when the astrostations are located 1,700-km^2 apart. The maximum error is 5 inches. (2) The use of a detailed gravimetric survey with a density of one point to each 5 km^2, a sufficient number of class I astrostations, and the Molodenskiy method permits the computation of the astronomic–geodetic deflections of the veritical components with an accuracy of several tenths of a second of arc. (3) The astronomical coordinates must be observed with high precision at the stations to achieve an actual accuracy in the determination of deflections of ±0.1 inches. I.v.L.

N64-22727 Joint Publications Research Service Washington, D.C.
STUDIES ON THE ACCURACY OF POINT-CONCENTRATION WITHIN A MODEL
Jeno Nagy 21 May 1964 17 p refs Transl. into ENGLISH from Geodezia es Kartografia (Budapest), v. 16, no. 1, 1964 p 28–34
(JPRS-24700; OTS-64-31301) OTS: $0.50

Results of investigations on the accuracy of point-concentration within a model indicate the following: (1) The values of differences between distances determined photogrammetrically and those calculated from geodetic coordinates are approximately the same in the 2-m to 400-m range. (2) The differences are independent of the length of the distance. Among the distances compared, the minimum difference was 0.0 m; the maximum difference was 0.19. These results calculated from model coordinates and from geodetic coordinates lead to the conclusion that photogrammetric coordinate determination is uniequivocal and reliable. I.v.L.

N64-22735 Joint Publications Research Service, Washington, D.C.
RESULTS OF MAGNETOTELLURIC INVESTIGATIONS IN GEORGIA
M. N. Berdichevskiy and G. A. Chernyavskiy 16 Jun. 1964 8 p Transl. into ENGLISH from Razvedka i Okhrana Nedr (Moscow), no. 4, 1964 p 35–39
(JPRS-25089; OTS-64-31485)

According to magnetotelluric data, to the east of Kakabeti there is a sharp plunging of the crystalline basement, which can be tentatively associated with a deep fault of meridional direction. In the vicinity of Khevsurtsopeli and farther to the east, magnetotelluric sounding data and data from a long-period telluric survey indicate a deep position of the crystalline basement. These and other observations indicate that the Georgian block plunges from the Dzirul'skiy complex in a northwest to southeast direction. I.v.L.

N64-22739 Joint Publications Research Service, Washington, D.C.
LABORATORY AND FIELD RESEARCH INTO THE PIEZOELECTRIC EFFECT OF NEPHELINE-CONTAINING ROCKS
E. I. Parkhomenko 17 Jun. 1964 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 155, no. 6, 1964 p 1314–1316
(JPRS-25-126; OTS-64-31504) OTS: $0.50

Laboratory and field investigations of rocks containing a piezoelectric mineral, nepheline, have expanded the list of rocks having the piezoelectric effect and have demonstrated the possibility of recording the piezoelectric effect of such rocks, under natural conditions. This provides a basis for the development of a new geophysical method for defining rocks with a high nepheline content. I.v.L.

N64-22748* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
EFFECTS OF NON-PHOTOCHEMICAL PROCESSES ON THE MERIDIONAL DISTRIBUTION AND TOTAL AMOUNT OF OZONE IN THE ATMOSPHERE
Cuddapah Prabhakara Washington, NASA, Jun. 1964 38 p refs
(NASA-TN-D-2106) OTS: $1.00

The photochemical equilibrium distribution of ozone below 41 km was computed for the solstices and equinoxes from recent rocket observations of the solar ultraviolet energy received at the top of the atmosphere. An attempt was made

to investigate the important part played by the mean seasonal transport processes in distributing the ozone below 41 km in the stratosphere. It was assumed that a steady-state meridional distribution of ozone is produced when photochemical and transport processes are acting together. Relevant theory and numerical procedure to compute such a steady-state meridional distribution of ozone were developed. To make a model of the transport processes needed for the calculation of the distribution of ozone, theoretical and observational information available at present on the various transport processes present in the stratosphere is reviewed. Further, in the calculations of ozone, an attempt was made to combine the mean meridional motions and the large scale mixing processes within the limits acceptable to the current ideas on these transport processes. The seasonal distribution of total ozone thus computed from the model of the transport processes and with an assumption of steady-state condition showed a satisfactory agreement with the observed seasonal and latitudinal variation of total ozone. The mean annual total ozone variation with latitude deduced from the computed seasonal distribution of total ozone demonstrated the ability of the method developed to account for the mean annual total ozone variation with latitude observed in the earth's atmosphere. The model of the transport processes developed to calculate the distribution of ozone in the atmosphere emphasizes the importance of the large scale eddy diffusion processes. The theoretical and observational findings from the spread of W^{185} (a radioactive isotope of tungsten introduced into the stratosphere by nuclear explosions) were very useful in making this model of the transport processes. Author

N64-22800 Bureau of Mines, College Park, Md.
A CASE STUDY OF THE VALIDITY OF SCALING LAWS FOR EXPLOSION-GENERATED MOTION
Harry R. Nicholls 1964 19 p refs
(BM-RI-6472)

As part of the preshot and postshot mine examination at Project GNOME, acceleration data were recorded underground from a series of chemical explosive shots. The cube root of the charge weight was used to scale acceleration and distance because charge weight was not constant. Regression analysis of particle acceleration–distance data gave the following propagation equation:

$$A W^{1/3} = 5.10 \times 10^5 (R/W^{1/3})^{-2.43}$$

The quantity $A W^{1/3}$ is scaled particle acceleration expressed in g-$lb^{1/3}$, and $R/W^{1/3}$ is scaled distance expressed in ft/$lb^{1/3}$. Data obtained from the nuclear explosion were scaled and fall within one standard deviation of the calculated propagation law for the smaller shots. Cube-root scaling laws were adequate to group acceleration data from explosive charges varying by a factor of more than 1×10^7 in charge weight and over shot-to-gage distances varying from 100 to 46,000 ft. Data obtained from a series of small tests provided sufficient data from which reliable predictions of acceleration could be made for the large nuclear explosion. Author

N64-22920 Minnesota U., Minneapolis School of Physics
ATMOSPHERIC PHYSICS Annual Progress Report, Apr. 1964
Apr. 1964 91 p refs
(Contract Nonr-710(22))
(AD-600940)

Three papers dealing with various aspects of atmospheric physics are presented: (1) "Vertical Distribution of the Dust in the Atmosphere"—measurements of the total ambient aerosol concentration in the stratosphere and of the associated size distribution; (2) "Atmospheric Small Ions and Dust"—an investigation of the mean size of the particles found in atmospheric aerosols; and (3) "Atmospheric Ozone"—a discussion of ozone soundings taken in the troposphere and stratosphere. P.V.E.

N64-22929* National Aeronautics and Space Administration, Washington, D.C.
ION EXCHANGE PROCESSES IN THE UPPER ATMOSPHERE [IONNO-OBMENNYYE PROTSESSY v VERKHNEY ATMOSFERE]
A. D. Danilov May 1964 19 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), no. 17, 1963 p 19–30
(NASA-TT-F-8525)

Theoretical considerations concerning the mechanisms of formation of various ions in the atmosphere and experimental studies of the rate coefficients of various reactions in the laboratory suggest that rapid ion-exchange processes take place in the upper atmosphere. Especially significant are reactions between atomic ions and molecules that lead to the formation of molecular ions and thus sustain the high recombination rate in the ionosphere. Recent experiments on the major ion-exchange reactions in the ionosphere yield a value of the order of $(5 - 10) \cdot 10^{-2}$ $cm^3 \cdot sec^{-1}$ for the constant of this reaction. This value is substantially smaller than the laboratory data presented in this article indicate, but agrees well with ionospheric estimates of α_{11}. Therefore, the constants of the major ionospheric ion-exchange processes may differ substantially from the high constants usually obtained in the laboratory for reactions with the participation of hydrocarbons and inert gases. Author

N64-22933* National Aeronautics and Space Administration, Washington, D.C.
INVESTIGATION OF THE STRATOSPHERIC AND TROPOSPHERIC THERMAL RADIATION FIELDS IN THE INFRARED REGION OF THE SPECTRUM WITH THE AID OF GEOPHYSICAL BALLOONS [ISSLEDOVANIYE POLYA TEPLOVOGO IZLUCHENIYA STRATOSFERY i TROPOSFERY v INFRAKRASNOY OBLASTI SPEKTRA s GEOFIZICHESKIKH AEROSTATOV]
M. N. Markov, Ya. I. Merson, and M. R. Shamilev Feb. 1964 23 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, 1963 p 235–248
(NASA-TT-F-8815)

Described are the apparatus and results of an investigation of the terrestrial and atmospheric thermal radiation fields based on measurements of the angular distribution made with the aid of geophysical balloons. Experimental data are presented on the shape of the angular distribution curve, the isotropicity, and the correlation between meteorological inhomogeneities and the measured thermal radiation for a wide interval of the infrared region of the spectrum. A discrepancy is revealed between the experimental data on the form of the angular distribution and theoretical calculations. Author

N64-22935* National Aeronautics and Space Administration, Washington, D.C.
IONIZATION OF ARGON IN THE UPPER ATMOSPHERE [OB IONIZATSII ARGONA v VERKHNEY ATMOSFERE]
A. D. Danilov Jan. 1964 9 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, Sep.–Oct. 1963 p 256–260
(NASA-TT-F-8817)

The problems of the formation and disappearance of argon ions in the atmosphere are discussed. It is shown that radiative recombination alone cannot be the mechanism of

the disappearance of these ions. The lower limit of the rate constant of the ion exchange reactions that should be responsible for the disappearance of A^+ ions is estimated. The distribution of these ions with altitude is obtained. Author

N64-22944* National Aeronautics and Space Administration, Washington, D.C.
VARIATIONS IN THE TOTAL AMOUNT OF OZONE AND THEIR RELATIONSHIP TO TEMPERATURE CHANGES IN THE STRATOSPHERE [VARIATSII OBSHCHEGO SODERZHANIYA OZONA I IKH SVYAZ' S IZMENENIYAMI TEMPERATURY V STRATOSFERE]
R. D. Bozhkon 1964 8 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 4, no. 1, 1964 p 137–140
(NASA-TT-F-9016)

The correlation coefficients, R, were calculated for diurnal variations of the total amount of ozone and the corresponding temperature changes at 100-, 50-, 25-, and 10-mb levels over Oxford, Arosa, and Rome during the period of the IGY. It was found that $R > 0$, but it changes very rapidly without any regularity in the course of a year. It was also found that there exists a latitudinal effect: R has the greatest value over Oxford (52° N) and the smallest value over Rome (42° N). At 100-mb levels, and especially at 50-mb levels, the values of R decrease. These facts, as well as sharp differences in the magnitudes of R, calculated for different levels at the same station or for different stations at the same level within the period of one month, enable us to presume that they result from vertical and advective movement due to specific circulation phenomena. Author

N64-22945* National Aeronautics and Space Administration, Washington, D.C.
VARIATIONS IN THE ALTITUDES OF THE MAXIMUM ELECTRON CONCENTRATION OF THE F_2 REGION [IZMENENIYE VYSOT MAKSIMAL'NOY ELEKTRONNOY KONTSENTRATSII OBLASTI F_2]
T. A. Anufriyeva Jun. 1964 8 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 4, no. 1, 1964 p 180–184
(NASA-TT-F-9019)

A complete picture is presented of the geographic distribution over Eurasia of the deviations of $h_{max}F2$ from the median values during quiet days and during days with disturbances, and the probability p of time variations of h_{max} at various latitudes is considered. The work is based on the data of 39 stations of the world network, which cover latitudes from 70° N to 70° S. Results confirm earlier conclusions on the high stability of h_{max}. Substantial increases in h_{max} are possible during the period of strong, negative, ionospheric magnetic disturbances. Substantial decreases in h_{max} are rare, and the region with such variations is limited basically by the "preequatorial" latitudes. D.E.W.

N64-22953 New York U., N.Y. Geophysical Sciences Lab.
A DIABATIC WEATHER PREDICTION MODEL WITH A CONSISTENT ENERGY INTEGRAL Scientific Report No. 4
Joseph P. Gerrity, Jr. Mar. 1963 47 p refs
(Contract NONR-285(09))
(GEOPHYS. Sci. Lab. Rept.-63-06; AD-403461)

Spar's vertically integrated, diabatic model is modified so that it possesses an invariant mass integral of the sum of enthalpy and the kinetic energy of the nondivergent wind in the adiabatic case. The model's linear characteristics are discussed, and a series of numerical experiments utilizing idealized initial conditions is proposed. Author

N64-23018 Library of Congress, Washington, D.C. Aerospace Information Div.
MAGNETIC OBSERVATIONS OF THE EARTH'S CRUST Review Article
S. Blinstrubas 3 Jun. 1964 39 p refs Transl. into ENGLISH from Soviet Publ.
(AID-P-64-38; AD-60181) OTS: $3.60 ph

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11. DETERMINATION OF THE DEPTH AND SHAPE OF A DISTURBING FORMATION BY MEANS OF MAGNETIC PROFILES [CONDENSED TRANSLATION FROM ORIGINAL GERMAN] p 32–34 refs

N64-23029* National Aeronautics and Space Administration, Washington, D.C.
ABSORPTION OF ATMOSPHERIC THERMAL RADIATION IN THE 9.6 μ OZONE BAND REGION [O TEPLOVOM IZLUCHENII 9.6 MK-POLOSY POGLOSHSCHENIYA OZONA V ATMOSFERE]
K. Ya. Kondrat'yev and Kh. Yu. Niylisk Jun. 1964 29 p refs Transl. into ENGLISH from Probl. Fiz. Atmosfery, Sb. 2, Izd. Leningradskogo Univ., 1963 p 3–27
(NASA-TT-F-207) OTS: $0.75

The purpose of this article is to determine, on the basis of new experimental data, the absorption (transmission) function of the atmosphere in the ozone-band region (9.0μ to 10.3μ) and to apply the absorption (transmission) function obtained to the investigation of the effect of various factors (changes in the content and stratification of O_3 and H_2O in the atmosphere, thermal stratification, etc.) on the radiant flux of the thermal emission of ozone. The fraction of the total thermal radiant flux that represents the thermal radiant flux in the 9μ to 10.3μ spectral region is discussed. Author

N64-23035* National Aeronautics and Space Administration, Washington, D.C.
ATMOSPHERIC DENSITY VARIATIONS AT HEIGHTS ABOVE 200 KM [VARIATSII PLOTNOSTI ATMOSFERE NA VYSOTAKH BOLEYE 200 KM]

V. V. Mikhnevich Oct. 1963 17 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), no.17 1963 p 31–41 (NASA-TT-F-8526)

Variations in atmospheric density, as observed by satellites at heights over 200 km, are discussed, and the relationship to solar activity, measured by solar radio emission at the 20-cm wavelength, is described. Diurnal atmospheric density variations were observed and ascribed to the daily cyclic exposure to the impinging solar wind. A monthly effect and a semiannual effect are noted, and solar rotation and the interaction of the ionosphere with the interplanetary plasma are suggested as the respective causes. An effect due to changes in geomagnetic activity is described, and the effect of latitude on atmospheric density is discussed. D.E.W.

N64-23036* National Aeronautics and Space Administration, Washington, D.C.

ELECTROSTATIC FIELD STRENGTH MEASUREMENTS WITH SPUTNIK III [IZMERENIYE NAPRYAZHENNOSTI ELEKTROSTATICHESKOGO POLYA NA TRET'YEM ISKUSSTVENNOM SPUTNIKE ZEMLI]

I. M. Imyanitov and Ya. M. Shvarts Oct. 1963 9 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), no. 17, 1963 p 59–65

(NASA-TT-F-8528)

An analysis of the electrostatic field strength measurements by Sputnik III indicates the following: (1) The average area of the Sputnik surface on which a positive current can flow is, at most, not smaller than the area on which a negative current can flow. Thus the observed longer duration of a positive field, as compared to the duration of a negative field, indicates an average negative charge on the Sputnik during those portions of the trajectory where the intensity of the electrostatic field was measured. (2) Changes were observed in the intensity of the electrostatic field that did not correlate with the parameters of the detector related to the course, the sun, or the magnetic field. Some of these changes are connected with intensive accumulation of electrostatic changes on the Sputnik. (3) Improved methods, which permit the exclusion of the effects produced by noise currents, may be used to elucidate the sources of these variations and their relation to the characteristic of the medium. I.v.L.

N64-23038* National Aeronautics and Space Administration, Washington, D.C.

THE DISTRIBUTION OF HELIUM, NITROGEN AND ARGON IN THE EARTH'S ATMOSPHERE UP TO 430 KM [O RASPREDELENII GELIYA, AZOTA I ARGONA V ZEMNOY ATMOSFERE DO VYSOTY 430 KM]

A. A. Pokhunkov Nov. 1963 20 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 1, no. 1, Jul.–Aug. 1963 p 147–155 Previously Published as a Part of FTD-TT-63-968/1+2+4; See N64-21636 15-12

(NASA-TT-F-8566; FTD-TT-63-968/1+2+4)

Results are presented of investigations of the neutral composition of the atmosphere with the aid of a radiofrequency mass spectrometer carried aloft in a geophysical rocket. Data on the temperature distribution of the atmosphere between 130 and 430 km and on measurements of the absolute concentrations of molecular nitrogen are given. Gravitational separation of the gases Ar and N_2 was observed. Other data relate to the upper limit of concentration of neutral helium and the distribution of helium ions at altitudes above 370 km. Author

N64-23039* National Aeronautics and Space Administration, Washington, D.C.

APPARENT MIGRATION OF THE EARTH IN THE LUNAR SKY [VIDIMYYE PEREMESHCHENIYA ZEMLI NA NEBE LUNY]

V. V. Shevchenko Jan. 1964 8 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 1, no. 2, Sep.–Oct. 1963 p 216–220

(NASA-TT-F-8812)

The general nature of the apparent migrations of the earth in the lunar ecliptic and horizontal systems of coordinates is ascertained. Formulas are derived for compilation of ephemerides. G.D.B.

N64-23044* National Aeronautics and Space Administration, Washington, D.C.

DENSITY AND INTENSITY DISTRIBUTION OF CHARGED PARTICLES IN A STATIONARY GEOMAGNETIC FIELD, WITHOUT CONSIDERING PARTICLE INTERACTION [O RASPREDELENIYE PLOTNOSTI I INTENSIVNOSTI ZARYAZHENNYKH CHASTITS BEZ UCHETA VZAIMODEYSTVIYA V STATSIONARNOM GEOMAGNITNOM POLE]

V. D. Pletnev Feb. 1964 17 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 3, Nov.–Dec. 1963 p 403–413

(NASA-TT-F-8829)

The asymptotic method of solving the Boltzmann equation for a low-density ionized gas in a strong stationary magnetic field is applied to evaluate the density and intensity distribution of charged particles in the radiation belts of the earth. This method, which is based on the expansion of the distribution function for charged particles in inverse powers of the Larmor frequency, is extended to the conservation of the invariant of the longitudinal action of a particle in the magnetic field. For this purpose, an additional averaging of the distribution function over the oscillation period of the particle between the magnetic plugs is carried out. Various possible forms of the distribution function, together with the corresponding density and intensity distribution of charged particles in the field, are considered in these approximations. Author

N64-23049* National Aeronautics and Space Administration, Washington, D.C.

SEASONAL VARIATIONS OF THE SPACE DISTRIBUTION OF IONOSPHERIC DISTURBANCES AT THE HIGH LATITUDES OF THE NORTHERN AND SOUTHERN HEMISPHERES [O SEZONNOM IZMENENII PROSTRANSTVENNOGO RASPREDELENIYA IONOSFERNYKH VOZMUSHCHENII V VYSOKIKH SHIROTAKH SEVERNOGO I YUZHNOGO POLYSHARIZ]

R. A. Zevakina Jun. 1964 12 p refs Transl. into ENGLISH from Geomagnetizm i Aeronom i ya (Moscow), v. 4, no. 1, 1964 p 83–89

(NASA-TT-F-8878)

The seasonal variation of synoptic charts of the anomalous absorption, E_s with high limit frequencies ($fE_s > 4$ mc), and positive and negative deviations of f_0F2 from the median exceeding 20% is examined for the Northern and Southern Hemispheres. Anomalous changes in f_0F2 are observed more rarely and occupy much less space in the summer than in the winter hemisphere. Anomalous absorption observed simultaneously in both hemispheres appears earlier and is distributed over a much wider area in the summer than in the winter hemisphere. The regions of E_s with high limit frequencies are more stable and occupy more space in the Northern Hemisphere, irrespective of the season. Author

N64-23056* National Aeronautics and Space Administration, Washington, D.C.
ELECTRICAL CONDUCTIVITY OF THE UPPER ATMOSPHERE. I. MIDDLE LATITUDES [ELEKTROPROVODNOST' VERKHNEY ATMOSFERY. I. SREDNIYE SHIROTY]
M. N. Fatkullin Jun. 1964 30 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 4, no. 11, 1964 p 115–123
(NASA-TT-F-9014)

The altitude distribution of the coefficients of anisotropic conductivity in the upper atmosphere is analyzed. Proceeding from various models of the upper atmosphere, the limits for the variation in the values of the coefficients of conductivity in regions E and F2 are obtained. Author

N64-23057 Hokkaido U., Sapporo (Japan) Inst. of Low Temperature Science
ICE CONDITIONS IN LUTZOW-HOLM BAY, ANTARCTICA, 1956–59, PRESENTED ON THE BASIS OF PHOTO-INTERPRETATION
Kou Kusunoki and Nobuo Ono 1964 35 p refs *Its* Contrib. no. 670, Ser. A, No. 19

Based on airphotos taken by Lars Christensen's expedition (1937) and by the Japanese Antarctic Research Expedition (1957 and 1959), Antarctic ice features on the coastal area of Lutzow–Holm Bay, especially in the vicinity of Showa Base, are discussed. Pairs of airphotos covering the same areas in different years are used for a comparative study of the long-term changes in ice conditions, such as the flow rate of channel glaciers, and the decay of ice tongues. Sea ice conditions in the bay are studied on the basis of shipboard observations and airphotos. Author

N64-23059 Weapons Research Establishment (Australia) Australian Defence Scientific Service
A THEORETICAL STUDY OF THE CHANGES OCCURRING IN THE OZONOSPHERE DURING A TOTAL ECLIPSE OF THE SUN
B. G. Hunt Mar. 1964 24 p refs
(WRE-TN-PAD-84)

A theoretical investigation has been made into the variation of the ozone concentration in the atmosphere, which results from an eclipse of the sun. The variation of the ozone concentration with time was followed by numerically integrating the relevant differential equations, allowing for the change in the solar radiation intensity reaching the earth's atmosphere during the eclipse. The results show that an increase of only 0.6% occurs in the total ozone amount, and that the eclipse does not affect the ozonosphere below 45 km. The theoretical results are compared with experimental observations, and reasons are advanced for the discrepancy between the two. Author

N64-23113* National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENT OF THE ELECTROSTATIC FIELD STRENGTH AT THE SURFACE OF A ROCKET FLYING THROUGHT THE IONOSPHERE [IZMERENIYE NAPRYAZHENNOSTI ELEKTROSTATICHESKOGO POLYA U POVERKHNOSTI RAKETY VO VREMYA YEYE POLETA V IONOSFERE]
G. L. Gdalevich Oct. 1963 25 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), no. 17, 1963 p 42–58
(NASA-TT-F8527)

This article examines conditions at the surface of a rocket in the ionosphere in relation to electrostatic field measurements, describes the equipment used for these measurements on three vertically launched Soviet geophysical rockets, and reports and discusses the results of these experiments. N.E.A.

N64-23114* National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENT OF THE ELECTROSTATIC FIELD INTENSITY AT THE SURFACE OF GEOPHYSICAL ROCKETS MOVING IN THE UPPER ATMOSPHERIC LAYERS [IZMERENIYE NAPRYAZHENNOSTI ELEKTROSTATICHESKOGO POLYA U POVERKHNOSTI GEOFIZICHESKIKH RAKET, DVIZHUSHCHIKHSYA V VERKHNIKH SLATMOSFERE]
I. M. Imyanitov, G. L. Gdalevich, and Ya. M. Shvarts Oct. 1963 23 p refs Transl. into ENGLISH from Iskusstv. Sputniki Zemli (Moscow), no. 47, 1963 p 66–81
(NASA-TT-F-8529)

The following aspects of the problem are discussed: (1) measurement technique—the use and components of an electrostatic generator; (2) theoretical basis of the operations of the instrument—error in measurement of field intensity at the surface of a body; (3) effect of space charge at surface of sounding bodies on results of measurements; and (4) results of measurements. E.K.R.

N64-23120* National Aeronautics and Space Administration, Washington, D.C.
ON MEASURING THE DENSITY OF THE ATMOSPHERE WITH THE AID OF INSTRUMENTS MOUNTED IN AN UNORIENTED SATELLITE [OB IZMERENII PLOTNOSTI ATMOSFERY PRI POMOSHCHI PRIBOROV, USTANOVLENNYKH NA SPUTNIKE]
M. N. Izakov Dec. 1963 8 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 1, Jul.–Aug. 1963 p 156–158
(NASA-TT-F-8568)

A method is presented for using six manometers (mass spectrometers), mounted in a satellite in a definite manner, to determine the density and, at certain moments in the rotation of the satellite, the temperature of the atmosphere, without the need for auxiliary instruments to determine the orientation of the instruments to the incident flux. The method can be used to determine, correct to a few percent, the density of the upper atmosphere. P.V.E.

N64-23121* National Aeronautics and Space Administration, Washington, D.C.
MEASURING THE TEMPERATURE OF THE ATMOSPHERE WITH THE AID OF SATELLITE-BORNE INSTRUMENTS [OB IZMERENII TEMPERATURY ATMOSFERY PRI POMOSHCHI PRIBOROV, USTANOVLENNYKH NA SPUTNIKE]
M. N. Izakov [1963] 21 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 1, no. 1, Jul.–Aug. 1963 p 159–168
(NASA-TT-F-8569)

The accuracy is determined of computations of atmospheric temperature based on the readings of a pair of mass spectrometers or manometers mounted in a satellite. Conclusions are drawn concerning the necessary orientation of the satellite and the most favorable arrangement of the instruments. Author

N64-23125* National Aeronautics and Space Administration, Washington, D.C.
MASS-SPECTROMETRIC MEASUREMENTS ON THE DISTRIBUTION OF He^+, N^+, O^+, NO^+, AND O_2^+ IONS IN THE EARTH'S ATMOSPHERE UP TO AN ALTITUDE OF 430 KM [MASS-SPEKTROMETRICHESKIY IZMERENIYA RASPREDELENIYA IONOV He^+, N^+, O^+, NO^+ I O_2^+ V ZEMNOY ATMOSFERE DO VYSOTY 430 KM.]
A. A. Pokhunkov Feb. 1964 7 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, Sep.–Oct. 1963 p 267–270
(NASA-TT-F-8819)

The absolute concentrations of atmospheric ions obtained with a radiofrequency mass spectrometer, installed in a geophysical rocket, are given for an altitude of 130 to 430 km. Helium ions were detected at altitudes above 370 km.
Author

N64-23126* National Aeronautics and Space Administration, Washington, D.C.
A SERIES OF SMALL MASS SPECTROMETERS FOR INVESTIGATING THE COMPOSITION OF NEUTRAL AND IONIZED GASES IN THE UPPER LAYERS OF THE ATMOSPHERE [SERIYA MALOGABARITNYKH MASS-SPEKTROMETROV DLYA ISSLEDOVANIYA SOSTAVA NEYTRAL'NYKH I IONIZIROVANNYKH GAZOV VERKHNIKH SLOYEV ATMOSFERY]
V. A. Pavleko et al Feb. 1964 12 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, Sep.–Oct. 1963 p 287–295
(NASA-TT-F-8821)

The theory of the radiofrequency mass analyzer is briefly presented, and the schematic diagram and construction of the MX6401, MX6403, and MX6405 spectrometers are described. These spectrometers are designed for investigating the ion and neutral composition of the upper layers of the atmosphere in the region of light (from 1 to 4 amu) and heavy (from 12 to 56 amu) masses. Examples of the exploitation of the devices with the results of investigations on the composition of the upper layers of the atmosphere at various altitudes are also given.
Author

N64-23131* National Aeronautics and Space Administration, Washington, D.C.
COMPUTING THE VERTICAL DISTRIBUTION OF ATMOSPHERIC OZONE [O RASCHETE VERTIKAL'NOGO RASPREDELENIYA ATMOSFERNOGO OZONE]
V. M. Berezin and Yu. A. Shafrin Jun. 1964 11 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (USSR), v. 4, no. 1, 1964 p 131–136
(NASA-TT-F-9015)

On the basis of the mean vertical distribution of ozone over Arosa, the effect of vertical currents and turbulence on ozone distribution is estimated by using numerical analysis of the continuity equation. Preliminary information is obtained on the interrelationship of these factors in combination with the photochemical equilibrium factor.
Author

N64-23132* National Aeronautics and Space Administration, Washington, D.C.
THE APPLICATION OF THE BASIC CONCLUSIONS OF STORMER'S THEORY FOR THE EXPLANATION OF SOME LAWS OF MAGNETIC DISTURBANCES AT HIGH ALTITUDES [O PRIMENIMOSTI OSNOVNYKH VYVDOV TEORII SHTERMERA DLYA OB'YASNENIYA NEKOTORYKH ZAKONOMERNOSTEY MAGNITNYKH VOZMUSHCHENIY V VYSORIKH SAIROTAKH]
A. P. Nikol'skiy Jun. 1964 16 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 4, no. 1, 1964 p 141–150
(NASA-TT-F-9017)

The distribution of irregular magnetic disturbances during 24-hr periods is investigated using the data of various observations conducted over a period of 145 months (1950-60) on drifting stations and at the Tikhaya, Chelyuskin, and Uelen stations. The existence of irregular magnetic disturbances of the fourth postmidnight maximum is shown in the diurnal distribution. If it is assumed that the effective region for the radiation of corpuscles (the zone of capture of solar corpuscles by the magnetic field of the earth) is the region situated in the plane of the geomagnetic equator and displaced by 30° to the east from the sun, then the observed instants of the four maxima, recomputed to the local geomagnetic time (LGT) relative to this source, practically coincide with the theoretical instants of impact zones on the Störmer spiral of corpuscular precipitation. Apparently, the fluctuations of the instants of origin of irregular disturbances are determined by the variation in the position of the effective source of radiation with respect to the earth; the number of maxima during a 24-hr period, and their relative intensity, depends on the distribution of particles in the capture zone in terms of the parameters γ and the variation of this distribution from day to day.
Author

N64-23139 Army Cold Regions Research and Engineering Lab., Hanover, N.H.
PENETRATION OF SHAPED CHARGES INTO FROZEN GROUND. PART II
Robert Benert Nov. 1963 21 p refs
(CRREL-TR-130; AD-433194)

The effect of various parameters was studied to design a charge that would do the work of the U.S. Army M2A3 (15 lb) shaped charges with as large a saving in weight as possible. Shaped charges of special design with a 4-in. diameter and weighing from 2 1/2 to 3 1/2 lb were fired into frozen ground. Data were obtained on the effect of standoff, charge weight and cone material, thickness, and angle. Results of the testing showed that a hole 5 ft deep and 1.7 in. in diameter in frozen ground can be obtained with a shaped charge weighing 2.8 lb. Aluminum cones are superior to copper or steel cones. Machined aluminum cones give greater penetration than rotary-extruded aluminum cones. A 75° cone angle gave the best results. A thickness of 0.2 in. for the cone meets the minimum weight requirements.
Author

N64-23145 Texas U., Austin Electrical Engineering Research Lab.
THE ATTENUATION AND EMISSION IN THE EARTH'S ATMOSPHERE OF THE COMPLEX OF 60 GC/S OXYGEN LINES Final Research Report, 1 Sep. 1961–30 Apr. 1964
C. W. Tolbert, A. W. Straiton, and R. A. Simons 30 Apr. 1964 59 p refs
(Contract AF 33(657)-7333; ARPA Order 216-61; Proj. Defender)
(Rept.-5-53; AD-439245)

This report is a summary of the investigation of the emission and absorption characteristics of the oxygen in the earth's atmosphere between sea level and 100,000 ft over the frequency interval of 58 to 62 kmc/s. The measurement of the emission and absorption of real and simulated atmospheres are described and the results of the data analysis presented. The attenuation in the earth's atmosphere between 58 and 62 kmc/s is caused primarily by 25 major oxygen lines centered at approximately 60 kmc/s. Over the vertical altitude interval from sea level to 100,000 ft the values of attenuation at line

center frequencies and at frequencies between the lines are 200 db and 145 db, respectively. The zenith emission into space from an altitude of 100,000 ft is essentially independent of the incident solar energy and equivalent to that from a black body at a temperature of 220° K between the lines and 225° K at line center frequencies. The attenuation and emission of the atmosphere, with the limits of atmospheric variability, were described by previously derived equations. Author

N64-23147 Argentina Comision Nacional De Energia Atomica, Buenos Aires

STUDY OF THE MOVEMENT OF SANDS IN THE NEIGHBORHOODS OF THE PORT OF MAR DEL PLATA USING SAND TAGGED WITH ^{110}Ag [ESTUDIO DEL MOVIMIENTO DE ARENAS EN LAS CERCANIAS DEL PUERTO DE MAR DEL PLATA USANDO ARENA MARCADA CON ^{110}Ag]

Federico Lachica and Gregorio B. Baro Dec. 1963 13 p refs *Its* Informe no. 100 In SPANISH Presented at Conf. Interam. de Radioquimica, Montevideo, Jul. 1963

The importance of the study of submarine sand movement is mentioned, and the criteria of selection of tracer isotopes are described. Isotopes that emit only alpha or beta radiation are stated to be of little value. Energetic gamma emitters with half-lives between some days and several months are regarded as more adequate. Therefore Ag tagging by deposition of matallic granules was chosen, and the procedure of tagging a ton of sand is discussed. The deposition of the marked sand on the sea bottom is described. Taking and measuring of samples are detailed; and an evaluation of the method is made for reproducibility and convenience. Trans. by D.E.W.

N64-23169 Tubingen U. (W. Germany) Astronomisches Inst.

TEMPERATURE FLUCTUATIONS IN THE ATMOSPHERIC GROUND LAYER OBSERVED AT ZEEKOEGAT AND FLATHILL (SOUTH AFRICA) European Southern Observatory Publication

Einrich Siedentopf and F. Unz Mar. 1964 24 p refs

Test measurements of temperature fluctuations in the atmospheric ground layer are described. From the measurements, it was noted that the ground layer significantly contributes to the seeing values registered. The method described for the measurement of the distribution of temperature fluctuations with height is a convenient way to objectively register this part of the image motion that is made in the deep ground layer. The decrease of ΔT with height recommends the use of high domes, for all-purpose observations, that are sensitive to image motion (spectroscopy, and photography with great focal length). N.E.A.

N64-23170 Royal Aircraft Establishment, Farnborough (Gt. Brit.)

THE DETERMINATION OF SOME PARAMETERS OF THE EARTH'S ATMOSPHERE FROM THE MOTION OF SATELLITES [OPREDELENIE NEKOTORYKH PARAMETROV ZEMNOI ATMOSFERY PO DVIZHENIYU SPUTNIKOV]

A. M. Fominov London, Min. of Aviation, Mar. 1964 8 p refs Transl. into ENGLISH of Astron. Tsirkulyar, no. 255, 1963

(RAE-TRANS-1059)

From the variations in the orbital periods of the satellites Vanguard 3 and Explorers 1, 8, and 11, an attempt is made to derive upper atmosphere density and its variation with latitude, longitude, and solar activity. Author

N64-23215 Academy of Sciences (USSR), Moscow

INVESTIGATIONS OF THE UPPER ATMOSPHERE AND OUTER SPACE CARRIED OUT IN THE USSR IN 1963

[1964] 87 p Presented at the Seventh COSPAR Meeting, Florence May 1964

The following topics are included: (1) investigations of the upper atmosphere and circumterrestrial outer space by means of satellites of the Cosmos series and by rockets; (2) maneuverable space vehicles of the Polyot series; (3) investigations of deep space and of planets; (4) results of exobiological investigations; (5) results of medical and biological investigations carried out during flights of Vostok 5 and Vostok 6; (6) optical tracking of satellites; (7) some results of space investigations by ground-based methods; and (8) the program of satellite and rocket scientific investigations during the International Quiet Sun Year. R.T.K.

N64-23226 California U., Berkeley Lawrence Radiation Lab.

DIRECT OBSERVATIONS OF MIRRORING PROTONS IN THE SOUTH ATLANTIC ANOMALY

Harry H. Heckman and George H. Nakano (Lockheed Missiles and Space Co.) 15 May 1964 24 p refs

(Contract W-7405-ENG-48)

(UCRL-11409)

Nuclear track emulsions recovered from oriented polar-orbiting satellites are being used to carry out a systematic study of the high-energy geomagnetically trapped protons ($E > 58$ Mev) in the region of the South Atlantic anomaly. Because the trapped protons are detected only at their minimum mirror-point altitudes, they are confined to a plane normal to the local magnetic field. The east–west asymmetry in the flux of trapped protons is observed and measured. From the magnitude of the asymmetry, particle scale heights are determined. At altitudes near 400 km, the measured scale height is $h \approx 70$ km, in agreement with values of scale heights deduced from model atmospheres when the averaging effects due to the particle's longitudinal drift and mirror oscillations are taken into account. The omnidirectional differential energy spectrum of protons $58 < E < 600$ Mev is found to be similar in shape to previous measurements of the high energy-proton spectra for L values ≤ 1.5. Author

N64-23282 Weapons Research Establishment (Australia)

IONOSPHERIC DATA FOR SEPTEMBER 1963, FROM WOOMERA, SOUTH AUSTRALIA Ionospheric Data Bulletin

Feb. 1964 24 p ref

(CPD-1963/9(W))

Tables of the hourly values of the customary ionospheric parameters are given for the station at Woomera for September 1963. Author

N64-23318 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MAXIMUM GAS-BUBBLE PRESSURE METHOD AS APPLIED TO DETERMINATION OF SURFACE TENSION OF METALS OF THE IRON FAMILY

V. V. Fesenko and V. N. Yeremenko (Akad. Sci. Ukr. SSR) *In its* Transactions of the Seminar on Heat-Resistant Materials 1959 p 23–44 refs (See N64-23316 16-01)

A general method is developed for computing surface tension by the method of maximum gas bubble pressure, taking the wetting angle into account in cases where the liquid does not wet the interior of the capillary. The surface tension of nickel measured in helium at temperatures of 1,500°, 1,600°, and 1,700° C was 1,520 ±60 ergs/cm^2, and was virtually independent of temperature. The surface tension of cobalt was measured at 1,600° C in hydrogen and helium. The

surface tension of cobalt does not depend on the nature of the gas and is 1,600 ±60 ergs/cm^2. The surface tensions of electrolytic iron and of iron produced by vacuum sublimation were measured. The surface tension of iron does not depend on the nature of the gas, at 1,650° C, and the values obtained were 1,260 ±90 and 1,415 ±90 ergs/cm^2, respectively. P.V.E.

N64-23321 Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHIC RESEARCH: EQUIPMENT AND TECHNIQUES
15 Jun. 1964 81 p refs Transl. into ENGLISH from Okeanol. (Moscow), v. IV, no. 2, 1964 p 213–242, 342–353, 359–361
(JPRS-25068; OTS-64-31473) OTS: $2.00

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2. NATURAL RADIOACTIVITY OF OCEAN WATER N. I. Popov p 16–29 refs (See N64-23323 16-12)

3. CERTAIN BIOCHEMICAL ASPECTS OF A COMPARATIVE STUDY OF THE BLACK SEA, SEA OF AZOV AND CASPIAN SEA Z. A. Vinogradova p 30–48 refs

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6. SEMINAR ON STANDARDIZATION OF METHODS OF DETERMINING PRIMARY PRODUCTION, SPONSORED BY THE INSTITUTE OF OCEANOLOGY OF THE ACADEMY OF SCIENCES USSR AT THE BLACK SEA SCIENTIFIC RESEARCH STATION OF THE INSTITUTE OF OCEANOLOGY FROM 15 JULY THROUGH 15 AUGUST 1963 Yu. G. Kabanova p 75–78

N64-23322 Joint Publications Research Service, Washington, D.C.
MEASUREMENT OF SMALL VALUES OF RADIOACTIVITY ON EXPEDITIONS
K. A. Kotlyarov and L. M. Khitrov *In its* Oceanog. Res.: Equipment and Tech. 15 Jun. 1964 p 1–15 refs (See N64-23321 16-12)

This report discusses instruments developed for the measurement of radioactivity from an oceanographic vessel at sea. The instruments are as follows: (1) a proportional 4π-counter for the measurement of low β-activity; (2) a low-background instrument based on self-quenching gas-discharge counter used for the measurements of β-activity of the order of tens of decays per minute. Also, methods of measuring that use these instruments are given. I.v.L.

N64-23323 Joint Publications Research Service, Washington, D.C.
NATURAL RADIOACTIVITY OF OCEAN WATER
N. I. Popov *In its* Oceanog. Res.: Equipment and Tech. 15 Jun. 1964 p 16–29 refs (See N64-23321 16-12)

Experimental data on the content of various natural isotopes in ocean waters are presented. The most probable mean chemical composition of the radioactivity of ocean water is derived from these data. In addition, the energy of decay of the corresponding isotopes and of radioactive families was computed. I.v.L.

N64-23330 Library of Congress, Washington, D.C. Aerospace Information Div.
PHENOMENA IN THE UPPER ATMOSPHERE. COMPILATION OF ABSTRACTS FROM SOVIET LITERATURE
10 Apr. 1964 24 p refs
(AID-P-64-19; AD-435478) OTS: $2.60ph

Reported is a review of Soviet developments in selected problems in astrophysics and geophysics. Discussed are solar radiation and ionosphere, Van Allen Belts and cosmic rays, and arctic and antarctic communications. N.E.A.

N64-23361 Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
THE 1963 STATUS OF TROPOSPHERIC WIND PROFILES FOR AEROSPACE VEHICLE DESIGN
Norman Sissenwine 15 Oct. 1963 22 p *Its* Interim Notes on Atmospheric Properties, No. 37
(AD-600300)

The Handbook of Geophysics, oriented toward Air Force aerospace systems, is being revised. Data and methodologies applicable to design problems resulting from wind forces during near vertical vehicle boost have changed very considerably since the information on this problem area was provided for in the 1958 edition. Wind profile design criteria developed since the original handbook are reviewed. Some of the latest data and techniques are provided. This interim report presents only the highlights of the complete handbook to be issued soon. Author

N64-23461 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TWINKLING OF LIGHT SOURCES ON THE EARTH
A. S. Gurvich, V. I. Tatarskiy, and L. R. Tsvang *In its* Transactions of the Conf. of the Res. on the Twinkling of Stars 7 Nov. 1962 p 1–13 refs (See N64-23460 16-16)

Simultaneously with measurements of the magnitude of twinkling of a light source on the ground, it is possible to measure fluctuations in the index of refraction. Meteorological measurements were made of the temperature profiles in the atmospheric layer from 0.5 to 12 km, of the wind velocity profiles within the same limits, and of the wind direction. Results of measurements are given by considering the following: (1) distribution function of light fluctuation probability; (2) magnitude of twinkling as a function of the distance and of the meteorological conditions; and (3) correlation function of the fluctuation of light intensity in the plane perpendicular to the beam. E.K.R.

N64-23514 Joint Publications Research Service, Washington, D.C.
NOCTILUCENT CLOUDS AND COSMIC DUST ON EARTH
10 Jun. 1964 25 p refs Transl. into ENGLISH from Priroda (Moscow), no. 3, Mar. 1964 p 87–97
(JPRS-25011; OTS-64-31447) OTS: $0.75

CONTENTS:

1. THE NATURE OF NOCTILUCENT CLOUDS S. P. Dobrovol'skiy p 1–6 ref (See N64-23515 16-12)

2. COSMIC DUST ON EARTH B. I. Vronskiy et al p 7–22 refs (See N64-23516 16-12)

N64-23515 Joint Publications Research Service, Washington, D.C.
THE NATURE OF NOCTILUCENT CLOUDS
S. P. Dobrovol'skiy *In its* Noctilucent Clouds and Cosmic Dust on Earth 10 Jun. 1964 p 1–6 ref Previously Published as N64-10060 01-21 (See N64-23514 16-12)
OTS: $0.75

Two hypotheses are considered: the condensation theory and the meteor theory. Although the author favors the condensation theory, he does not affirm that noctilucent clouds consist exclusively of the products of cosmic water. A.W.

N64-23516 Joint Publications Research Service, Washington, D.C.
COSMIC DUST ON EARTH
B. I. Vronskiy and K. P. Florenskiy *In its* Noctilucent Clouds and Cosmic Dust on Earth 10 Jun. 1964 p 7–22 refs (See N64-23514 16-12)
OTS: $0.75

The nature of the interplanetary matter falling into the dust atmosphere of the earth is judged according to the average composition of meteorites. Attempts to study extraterrestrial dust are hampered, however, by the pollution of the earth's surface by industrial dust, and calculation data concerning the quantity of cosmic, as distinct from terrestrial, dust are often contradictory. A.W.

N64-23517* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OGO EARTH ACQUISITION
S. J. Paddack, R. A. Devaney, and H. E. Montgomery May 1964 164 p refs
(NASA-TM-X-55002; X-643-64-101) OTS: $12.00 ph

To "acquire" the earth means that the earth will be visible to the satellite in a certain fashion. The technique for predicting earth acquisition is a mathematical method that is developed into a computer program. Through the use of the program it is possible to predict when, after a reference time, the earth can be acquired by a particular satellite in a given orbit. The technique is a function of the kind of earth-search and acquisition device, the orbit, the launch date, and the time of day. The technique is applied and results are shown for two satellites in the OGO family—namely, for the Eccentric Orbiting Geophysical Observatory, EGO S-49, and for the Polar Orbiting Geophysical Observatory, POGO S-50. Author

N64-23580 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
UNDERGROUND EXPLOSION WAVES
G. M. Lyakhov and G. I. Polrovskiy 10 Feb. 1964 149 p refs Transl. into ENGLISH of the Book "Vzryvnyye Volny v Gruntakh" Moscow, Gosgortekhizdat, 1962 p 1–103
(FTD-TT-63-724/1+2+4; AD-435642)

CONTENTS:

1. THE ROLE OF WAVES GENERATED BY AN UNDERGROUND EXPLOSION IN BLASTING p 5–13
2. THE STRUCTURE AND BASIC ELEMENTS OF SOIL THAT DETERMINE THEIR BEHAVIOR UNDER DYNAMIC LOADS p 14–26
3. THE EQUATION OF STATE FOR WATER SATRATED GROUND. EXPERIMENTAL STUDIES OF THE COMPRESSIBILITY OF WATER-SATURATED AND UNSATURATED SOIL p 27–45
4. THE VELOCITY OF SOUND AND THE RELATIONSHIP BETWEEN THE SHOCK-WAVE FRONT IN UNSATURATED SOIL AND ENERGY LOSSES DURING WAVE-FRONT COMPRESSION p 46–56
5. PROPAGATION OF A PLANE WAVE IN WATER-UNSATURATED SOIL p 57–72
6. PROPAGATION OF A PLANE WAVE IN UNSATURATED SOIL p 73–102
7. EXPERIMENTAL INVESTIGATIONS OF BLAST WAVES IN WATER-SATURATED AND UNSATURATED SOILS p 103–133
8. THE SEISMIC ACTION OF AN EXPLOSION p 134–142

N64-23665 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE STUDY OF NOCTILUCENT CLOUDS Selected Parts
30 Oct. 1962 78 p refs Transl. into ENGLISH from Issled. Serebristykh Oblakov, Izd. Leningr. Univ. (Leningrad), no. 1, 1960 p 3–84
(FTD-TT-62-1341/1+2+4; AD-292196)

CONTENTS:

1. THE APPARENT FREQUENCY OF THE APPEARANCE OF NOCTILUCENT CLOUDS ACCORDING TO OBSERVATIONS BY THE STATIONS OF THE HYDROMETEOROLOGICAL SERVICE NETWORK IN 1957 AND 1958 T. D. Pavlova p 1–41 refs (See N64-23666 16-12)
2. CERTAIN CASES OF THE APPEARANCE OF BRIGHT NOCTILUCENT CLOUDS DURING THE SUMMER OF 1959 I. I. Lebedeva p 42–49 (See N64-23667 16-12)
3. PHOTOMETRIC AND COLORIMETRIC OBSERVATIONS OF NOCTILUCENT CLOUDS DURING THE SUMMER OF 1959 V. V. Sharonov p 50–64 refs (See N64-23668 16-12)
4. THE ABSOLUTE PHOTOMETRY OF THE TWILIGHT SKY AND NOCTILUCENT CLOUDS I. A. Parshin p 65–74 refs (See N64-23669 16-12)

N64-23666 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE APPARENT FREQUENCY OF THE APPEARANCE OF NOCTILUCENT CLOUDS ACCORDING TO OBSERVATIONS BY THE STATIONS OF THE HYDROMETEOROLOGICAL SERVICE NETWORK IN 1957 AND 1958
T. D. Pavlova *In its* The Study of Noctilucent Clouds 30 Oct. 1962 p 1–41 refs (See N64-23666 16-12)

A study is made of the apparent frequency of the appearance of noctilucent clouds in the Northern Hemisphere during the summer and in a latitude zone north of 45° N. The results of the observations of noctilucent clouds indicate their presence or absence, their brightness, and an estimate of their general coverage. J.R.C.

N64-23667 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CERTAIN CASES OF THE APPEARANCE OF BRIGHT NOCTILUCENT CLOUDS DURING THE SUMMER OF 1959
I. I. Lebedeva *In its* The Study of Noctilucent Clouds 30 Oct. 1962 p 42–49 (See N64-23665 16-12)

The appearance of bright noctilucent clouds during the summer of 1959 is investigated. In all cases, fan-like divergent

bands with point radiation on the northern horizon were noted. The visibility of noctilucent clouds was determined by comparing their brightness with that of the background sky. With simple visual observations, noctilucent clouds were clearly light blue in color. J.R.C.

N64-23668 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PHOTOMETRIC AND COLORIMETRIC OBSERVATIONS OF NOCTILUCENT CLOUDS DURING THE SUMMER OF 1959

V. V. Sharonov *In its* The Study of Noctilucent Clouds 30 Oct. 1962 p 50–64 refs (See N64-23665 16-12)

This investigation of photometric and colorimetric observations of noctilucent clouds during the summer of 1959 covers the following: single-time relative photometry; relative photometry at various times; standard photometry at various stations; and absolute photometric determinations. J.R.C.

N64-23669 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE ABSOLUTE PHOTOMETRY OF THE TWILIGHT SKY AND NOCTILUCENT CLOUDS

I. A. Parshin *In its* The Study of Noctilucent Clouds 30 Oct. 1962 p 65–74 refs (See N64-23665 16-12)

Photometric observations of the twilight sky and noctilucent clouds were made in the summer of 1959, by using a reflector having an objective diameter of 54 mm and a focal length of 550 mm. J.R.C.

N64-23848 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

TRANSACTIONS OF THE ACADEMY OF SCIENCES OF THE USSR, INSTITUTE OF EARTH'S MAGNETISM, THE IONOSPHERE, AND RADIO WAVE PROPAGATION Selected Articles

14 Feb. 1963 109 p refs Transl. into ENGLISH from Tr. Inst. Zemnogo Magnetizma, Ionesferi i Rasprostraneniya Radiovoln Akad. Nauk SSSR (Moscow), no. 17(27), 1960 p 216–281 (FTD-TT-62-1330/1+2+4; AD-298207)

CONTENTS:

1. COMPILATION OF PREDICTIONS OF THE GEOMETRIC PARAMETERS AND THE *h'f* FREQUENCY-HEIGHT CURVES OF THE IONOSPHERE B. S. Shapiro p 1–34 refs (See N64-23849 16-12)

2. A SHORT-RANGE PREDICTION OF THE STATE OF THE IONOSPHERE L. N. Lyakhova p 35–106 refs (See N64-23850 16-12)

N64-23849 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

COMPLIATION OF PREDICTIONS OF THE GEOMETRIC PARAMETERS AND THE h'f FREQUENCY-HEIGHT CURVES OF THE IONOSPHERE

B. S. Shapiro *In its* Trans. of the Acad. of Sci. of the USSR, Inst. of Earth's Magnetism, the Ionosphere, and Radio Wave Propagation 14 Feb. 1963 p 1–34 refs (See N64-23848 16-12)

The calculation and analysis of the geometric parameters of the ionosphere and the method of predicting the true and virtual heights (h') are discussed. To determine the geometric parameters of the ionosphere and calculate h', approximate methods and formulas for a parabolic layer were used. G.D.B.

N64-23850 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A SHORT-RANGE PREDICTION OF THE STATE OF THE IONOSPHERE

L. N. Lyarkhova *In its* Trans. of the Acad. of Sci. of the USSR, Ints. of Earth's Magnetism, the Ionosphere, and Radio Wave Propagation 14 Feb. 1963 p 35–106 refs (See N64-23848 16-12)

An examination of the space–time variability of the critical frequencies of the F-2 layer during disturbances showed that the layer does not vary more on quiet days than on stormy days, except for during large storms. This was the basis of compilation of a forecast by extrapolation several hours in advance, and is more accurate than a forecast using the average characteristics. G.D.B.

N64-23860 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THERMAL BALANCE OF THE EARTH

M. I. Budyko and K. Ya. Kondrat'yev *In its* Cosmic Res. 27 Apr. 1964 p 109–148 refs (See N64-23852 16-29)

World charts of the geographical distribution of components of the thermal balance of the earth's surface are plotted and discussed. Components of thermal balance averaged for the entire earth are computed. Data from calculations and measurements of the components of thermal balance for individual layers of the atmosphere are presented and analyzed. Author

N64-23861 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

UTILIZATION OF THE CONCEPT OF A STANDARD MODEL OF THE OUTGOING RADIATION FIELD OF THE EARTH AS A PLANET IN THE SCHEME OF SOLVING THE INVERSE RADIATION PROBLEM

V. A. Baryshev and G. N. Krylov *In its* Cosmic Res. 27 Apr. 1964 p 149–166 refs (See N64-23852 16-29)

Several methodological questions encountered in development of schemes for solution of the inverse problems of radiation are examined by statistical methods. The utilization of the introduced concept of a terrestrial radiation model makes it possible to apply known mathematical methods for treatment of experimental results. A simplified method for determining the vertical to the earth's surface is examined as an illustration. Author

N64-23882 Lockheed Missiles and Space Co., Sunnyvale, Calif.

THE GEOMAGNETIC FIELD: AN ANNOTATED BIBLIOGRAPHY

Eugene E. Graziano and Helen B. Mc Cormick, comp. Aug. 1963 64 p refs

(Contract AF 04(647)-787)

(SB-63-63; Rept. 3-56-63-2; AD-441621)

This bibliography consists of 183 selected references to recent literature on all aspects of the geomagnetic field, and to planetary and interplanetary fields. Actual measurements of magnetospheric phenomena were of particular interest. The time period covered in the literature survey was June 1962–June 1963, with selective coverage from 1958. Author

N64-23885 Library of Congress, Washington, D.C. Aerospace Information Div.

PHENOMENA IN THE UPPER ATOMOSPHERE Compilation of Abstracts from Soviet Literature

25 Jun. 1964 37 p refs
(AID-P-64-43; AD-601890) OTS: $3.60 ph

This is a collection of abstracts from Soviet scientific literature on upper atmosphere phenomena, including ionosphere electron concentrations, solar radiation, Van Allen belts, cosmic rays, telluric currents, atmospheric electricity, nuclear bursts in the atmosphere, satellite and missile data, Arctic and Antarctic communications, and upper atmosphere meteorology. G.D.B.

N64-23889 Buenos Aires U. (Argentina)
THE NOCTURNAL COLD LAYER IN THE TUNUYAN VALLEY Report No. 1
James G. Edinger 1963 61 p refs *Its* Fasciculo 4
(Sponsored by USAF)

This report describes a meteorological exploration of the cold layer of air that forms on relatively clear, calm nights in the lowest few hundred meters above the ground in the Mendoza Tunuyan area. In the wintertime, this layer can bring a damaging frost to the orchards and vineyards in this region. An attempt is made to reconstruct the three-dimensional temperature field of this layer and to relate it to the surface flow pattern, cloudiness, winds aloft, and the current synoptic situation. In this attempt, an instrumented light aircraft was used with a network of recording anemometers and a series of pilot balloon ascents. I.v.L.

N64-23904 Kakioka Magnetic Observatory (Japan)
REPORT OF THE GEOMAGNETIC AND GEOELECTRIC OBSERVATIONS 1961–1962
1964 205 p
(Rept.-3)

This report on geomagnetic and geoelectric observations carried out by the Kakioka Observatory covers results of observations of rapid variations, and records of the rapid-run induction magnetograms and rapid-run tellurigrams. J.R.C.

N64-23910 National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.
THE NORMAL PHASE VARIATIONS OF THE 18 KC/S SIGNALS FROM NBA OBSERVED AT BOULDER, COLORADO, U.S.A.
A. H. Brady, A. C. Murphy, and D. D. Crombie 10 Apr. 1964 30 p refs
(NBS-TN-206-3; AD-435848) GPO: $0.25

Observations of the normal phase variations of the 18-kc signals radiated from the Canal Zone and received in Boulder, Colorado, are given in the form of monthly averages and standard deviations at 5-minute intervals. The relations between the diurnal phase variations and the diurnal variation in the length of sunlit path are shown. The calculated mean diurnal change in effective height of reflection is 18 km. Values of the short-term phase differences are also given. Author

N64-23917 International Geophysical Year World Data Center A, New York, N.Y.
GLACIOLOGY Catalogue of Data Received by WDC-A, 1 Jul.–31 Dec. 1963
Jan. 1964 18 p refs

This is a review of glaciological data giving stations, programs, and a list of current publications on glaciology. The information is organized on a basis of national origin and includes all countries participating in the IGY program that send their findings to the World Data Centers. G.D.B.

N64-23918 Raven Industries, Inc., Sioux Falls, S. Dak. Metorology Dept.
LIGHT WINDS IN THE STRATOSPHERE (18 TO 24 km.) OVER THE UNITED STATES OF AMERICA
E. M. Frisby, R. Engel, and J. Mechels Jun. 1964 59 p
(Contract Nonr-4347(00))
(Rept.-1064; AD-437146)

Areas and altitudes of light winds between 50,000 ft and 80,000 ft were investigated for a representative network of stations across the United States. In general, it is concluded that calms in this altitude range occur too infrequently to be of operational value. P.V.E.

N64-23962 RAND Corp., Santa Monica, Calif.
A MODEL OF THE SEASONAL AND LATITUDINAL VARIATION OF ZONAL WINDS AND TEMPERATURES IN THE STRATOSPHERE ABOVE 30 KM
E. S. Batten Jun. 1964 33 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-4144-PR; AD-601348)

Meteorological rocket data were used to develop a model of the seasonal changes of wind and temperature in the stratosphere between the altitudes of 30 and 50 km. The model describes the spring and fall reversals of the zonal winds and meridional temperature gradients. In spring, the reversal of the temperature gradient and zonal wind begins at high altitudes in the polar and tropical latitudes and is complete by late May. The fall reversal of the temperature gradient is complete by the autumnal equinox. The reversal from summer easterlies to winter westerlies proceeding downward and equatorward from high polar altitudes is complete by late September or early October. Author

N64-23977 Lockheed Missiles and Space Co., Sunnyvale, Calif. Research Labs.
A SEMI-THEORETICAL MODEL FOR ATMOSPHERIC PROPERTIES FROM 90 TO 10,000 KM
Albert D. Anderson and William E. Francis May 1964 64 p refs
(Contract DA-49-146-XZ-204)
(LMSC-6-74-64-19; AD-600472)

A semitheoretical model of the upper atmosphere was constructed to allow the calculation of the primary atmospheric properties from 90- to 10,000-km altitude as a function of local time and solar activity. The calculations are based upon an empirical density profile from a density model as the initial input. Assuming diffusive equilibrium above 110 km and isothermal conditions above 400 km, the remaining properties (pressure, temperature, mean molecular mass, and the individual particle concentrations) are derived by using the hydrostatic equation and equation of state, together with boundary values from measurements. To illustrate the model, two tables are given that present the average atmospheric properties vs altitude for sunspot maximum and minimum conditions, respectively, for the months immediately following the Argus and Starfish high-altitude nuclear detonations. Author

N64-23982 Aerospace Corp., El Segundo, Calif. Space Physics Lab.
ARTIFICIALLY INJECTED ELECTRONS AT LOW ALTITUDES
J. D. Mihalov, F. S. Mozer, and R. S. White 25 May 1964 26 p refs
(Contract AF 04(695)-269)
(TDR-269(4260-20)-2; SSD-TDR-64-99; AD-601797)

Results are reported from experiments carried out in October and November, 1962, on satellites 1962$\beta\epsilon$ and 1962$\beta\alpha$. The data were obtained at 240 to 450 km above

the South Atlantic where the earth's magnetic field is weak. The fluxes and energy distributions of electrons injected by high-altitude nuclear explosions are presented. During November 6 through 11, 1962, the maximum omnidirectional flux measured from the Starfish injection was $1^{+2}_{-0.7} \times 10^6$ fission electrons cm^{-2} sec^{-1} at B = 0.223 gauss, L = 1.50. At the same time, the maximum omnidirectional flux measured from Soviet injections in October and November was $1.3^{+2.6}_{-0.9} \times 10^6$ fission electrons cm^{-2} sec^{-1} at B = 0.243 gauss, L = 1.77. The October flux at L = 2.1 was increased by more than a factor of 100 in November after the Soviet explosions. Author

N64-23999* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

INTERPARAMETER STATISTICAL ANALYSIS OF SURFACE WIND SPEED, TOTAL OPAQUE CLOUD COVER, AND MAXIMUM WIND SPEED ALOFT AT CAPE KENNEDY, FLORIDA

Oryel E. Smith, G. E. Truppi, and Harold L. Crutcher (Weather Bureau) 22 Apr. 1964 22 p refs
(NASA-TM-X-53037) OTS: $2.60 ph

This report provides a monthly analysis of the statistical relationships of surface wind, winds aloft, and total opaque cloud cover at Cape Kennedy. These data are based on 5 years of record, 1957 through 1961, and represent surface observations of wind speed and total opaque cloud cover coincident with RAWIN observations of maximum wind speeds in the 10- to 15-km layer. Data are presented as percentage occurrence of "go" to "no go" conditions where a favorable combination of all three parameters as to vehicle launch criteria represents a "go" condition, and a combination with one or more parameters unfavorable to vehicle launch is classified as "no go" condition. The vehicle launch criteria were arbitrarily chosen for the purpose of this report. Author

N64-24047* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

WIND FLOW IN THE 80-400 KM ALTITUDE REGION OF THE ATMOSPHERE

George C. Ragsdale and Peter E. Wasko 5 Jun. 1962 50 p refs Previously Published as NASA TN D-1573; See N63-14273 10-12
(NASA-TM-X-51724; MTP-AERO-62-49; NASA-TN-D-1573) OTS: $4.60 ph

An attempt is made to deduce the wind characteristics in the 80- to 400-km ionospheric region of the atmosphere for the purpose of establishing wind input data for launch vehicle and spacecraft design-and-performance studies. Although the amount of wind data available is far from desirable for such an undertaking, there is a sufficient amount of data to give at least an indication of the probable wind characteristics at these high atmospheric levels. The most important wind-measurement techniques are described, the wind data obtained from recent rocket techniques and from a literature survey of ionospheric drift measurements are presented, the probable maximum wind-speed envelope is established, the wind shears are determined, and some general wind-flow characteristics are deduced. Author

N64-24063 Lockheed Missiles and Space Co., Sunnyvale, Calif.

SUB ELF GEOMAGNETIC FLUCTUATIONS. VOLUME II: STATISTICAL STUDIES OF HYDROMAGNETIC EMISSIONS Final Report

R. C. Wentworth 26 Dec. 1963 68 p refs
(Contract AF 19(628)-462)
(Rept.-8-08-64-1,Vol. II; AD-437330)

An empirical formula giving attenuation as a function of F2 peak ion density and hydromagnetic wave frequency was applied to a 9-month data sample of hydromagnetic emissions (quasi-sinusoidal oscillations of the earth's magnetic field in the frequency interval around 1 cps). Under the hypothesis that these signals are attenuated as they propagate downward through the ionosphere as hydromagnetic waves, the amplitude and frequency spectrum above the ionosphere at middle latitudes was deduced. Author

N64-24065* National Aeronautics and Space Administation. Goddard Space Flight Center, Greenbelt, Md.

PITCH-ANGLE DISTRIBUTION OF THE PHOTOELECTRONS AND ORIGIN OF THE GEOMAGNETIC ANOMALY IN THE F_2 LAYER

F. Mariani Repr. from J. Geophys. Res., v. 69, no. 3, 1 Feb. 1964 p 556–560
(NASA-RP-213)

A major anomaly of the F region is the equatorial or geomagnetic anomaly, which consists of the pronounced minimum of f_0F_2 on the geomagnetic equator and two maximums near 20° north and south latitude, at meridian hours and in the afternoon, in every season. A simple mechanism that may play a role in the explanation of the anomaly is presented. The mechanism is based on a detailed analysis of the physical processes that the photoelectrons undergo in the upper atmosphere and on the idea that the anomaly could be at least partly the result of the redistribution of the photoelectrons produced locally due to the presence of the geomagnetic field. P.V.E.

N64-24085* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PULSATING AURORAE AND INFRASONIC WAVES IN THE POLAR ATMOSPHERE

Kaichi Maeda and Tomiya Watanabe (Brit. Columbia U.) Repr. from Journal of the Atmospheric Sci., v. 21, no. 1, Jan. 1964 p 15–29 refs
(NASA-RP-216)

Pulsating auroras are proposed as a source of the infrasonic waves associated with geomagnetic activity reported by Chrzanowski et al. One of the most plausible mechanisms for generating these long-period pressure waves is the periodic heating of the upper air around the 100-km level by auroral bombardment, during pulsating visual auroras. To see the energetic relation between source input and pressure change at sea level, some theoretical calculations are performed with a simple model of auroral distribution in an isothermal atmosphere. At least 100 erg cm^{-2} sec^{-1} of energy flux variation at auroral height is necessary to produce surface pressure amplitudes of the order of 1 dyne cm^{-2} in this model. The intensity of the pressure waves in this model decreases rapidly outside of the region of auroral activity, indicating the importance of sound ducts in the upper atmosphere for the propagation of these long-period sonic waves. I.A.A.

N64-24087 Travelers Research Center, Inc., Hartford, Conn.

RELATIONSHIPS BETWEEN TROPICAL PRECIPITATION AND KINEMATIC CLOUD MODELS Progress Report No. 5, 1 Aug. 1963–31 Jan. 1964

Edwin Kessler, III, Edward A. Newburg, and Geirmundur Arnason [1964] 45 p refs
(Contract DA-36-039-SC-89099)
(Rept.-7048-105; AD-437817)

When precipitation first appears near the top of a cloud that marks a column of moderate updrafts, the model precipitation at the ground is characterized by an initial gush and

then a decline to equilibrium values. When precipitation is first introduced at the base of such a cloud, the onset of precipitation at the ground is hastened, and the precipitation rate rises gradually to equilibrium. An improved technique for computing cloud and precipitation development in model updraft columns affects the answers only slightly. A two-dimensional rectilinear model circulation is presented with budget parameters independent of circulation intensity and microphysical processes. The model developments of vapor, cloud, and precipitation distributions in weak and strong circulations and in initially saturated and unsaturated atmospheres are illustrated. Approximately 83% of condensed water is precipitated from a weak circulation, which starts from initially saturated conditions; this declines to 60% for a strong circulation, which starts from unsaturated conditions. The omission of diffusive entrainment from the model may explain why the model precipitation efficiencies are much higher than estimates of Braham. Precipitation production seems to be most sensitive to the product of circulation intensity times duration, and only weakly sensitive to model microphysical parameters. However, the time of precipitation onset at the ground and the shape of the time-dependent water distributions in the atmosphere are quite responsive to changes of microphysical parameters and updraft speed. In the real world, microphysical parameters may significantly influence the extent of atmospheric overturning and precipitation production through forces that depend on the shape of the time-dependent water distributions. Author

N64-24099 Library of Congress, Washington, D.C. Aerospace Information Div.
PHENOMENA IN THE UPPER ATMOSPHERE. SOLAR RADIATION AND THE IONOSPHERE Compilation of Abstracts from Soviet-Bloc Literature
1 May 1964 16 p refs
(AID-P-64-32; AD-600050) OTS: $1.60 ph

This report contains 15 abstracts on the subject of solar radiation and the ionosphere. A.W.

N64-24149* Southwest Center for Advanced Studies, Dallas, Tex.
PERTURBATION OF THE GEOMAGNETIC FIELD—A SPHERICAL HARMONIC EXPANSION
James E. Midgley Repr. from the J. of Geophys. Res., v. 69, no. 7, 1 Apr. 1964 p 1197–1200 refs
(Grants NsG-269-62; NsG-151-61)

The spherical harmonic expansion of the perturbation of the geomagnetic field is calculated, using the magnetopause shape and current system determined previously by the moment technique. The expansion coefficients are compared with those determined by another method by Mead. Author

N64-24150 RAND Corp., Santa Monica, Calif.
THEORETICALLY PERMISSIBLE ALTITUDES AND SEASONS FOR THE OCCURRENCE OF CLOUDS NEAR THE MESOPAUSE
G. F. Schilling Apr. 1964 14 p refs Presented at Symp. on Noctilucent Clouds, Stockholm, 4–6 May 1964
(P-2899; AD-435637)

A thermodynamic exclusion principle is used to determine those regions in the earth's upper atmosphere where the formation of clouds due to condensation or sublimation of water vapor is or is not possible. The probability of occurrence of such clouds is then determined from model atmospheres as a function of altitude for different latitudes and seasons. The theoretical results correspond well with actually observed locations, frequencies, and altitudes of noctilucent clouds. Statistical analysis of certain noctilucent cloud data should not only permit experimental tests of the theoretical study, but also provide, by inference, information about variations of the mesopause altitude with latitude, season, and solar activity. Author

N64-24162 Library of Congress, Washington, D.C. Aerospace Information Div.
PHENOMENA IN THE UPPER ATMOSPHERE Review of Soviet Literature
26 Feb. 1963 18 p refs
(AID-P-63-28; AD-298588) OTS: $1.60 ph

Studies in the following areas of astrophysics and geophysics are discussed: (1) ionospheric electron concentrations; (2) solar radiation and the ionosphere; (3) Van Allen belts and cosmic rays; (4) telluric currents; (5) atmospheric electricity; (6) nuclear bursts in the atmosphere; (7) satellite and missile data; (8) arctic and antarctic communications; and (9) meteorology of the upper atmosphere. J.L.D.

N64-24198 Air Force Cambridge Research Labs., Bedford, Mass. Upper Atmosphere Physics Lab.
SUNRISE EFFECTS ON EAST-WEST IONOSPHERIC PROPAGATION PATHS
Thomas D. Conley and David Blood (Raytheon Co.) May 1964 18 p refs *Its* Environ. Res. Papers No. 14
(AFCRL-64-346; AD-601686)

The extent of propagation afforded by the ionosphere is analyzed during the sunrise period on long east–west paths. During this period the propagation conditions are examined as functions of distance along the path and of time. The propagation losses are attributed primarily to absorption in the lower ionosphere and the ground when multiple E-layer modes occur at the eastern end of the paths. Author

N64-24229* Iowa State U., Iowa City
SOLAR PROTONS AND THEIR GEOPHYSICAL EFFECTS
S. M. Krimigis Repr. from Iowa Acad. Sci., v. 70, 1963 p 393–402 refs
(Grant NsG-233)

A review of the present state of knowledge of solar particle emission is given, and the effect of this emission on geophysical phenomena is analyzed. It is pointed out that the particle emission can be categorized into continuous plasma emission and into occasional emission of solar cosmic rays. The plasma emission mainly determines the shape of the magnetospheric boundary, whereas the cosmic ray emission accounts for the geomagnetic storms, intense aurorae, ionization of the upper atmosphere, and Forbush decreases in the primary cosmic radiation. Author

N64-24232 Southwest Center for Advanced Studies, Dallas, Tex.
THERMAL UPPER LIMIT ON EDDY DIFFUSION IN THE MESOSPHERE AND LOWER THERMOSPHERE
Francis S. Johnson and Eugene M. Wilkins (Ling-Temco-Vought, Inc.) [1963] 13 p refs
(CWB-10531)

The thermodynamic stability of the mesosphere and lower thermosphere requires that there be a downward transport of heat associated with any turbulent mixing. The amount of available heat that could be transported downward through any level by eddy conduction can be determined from the absorption of solar energy above that level. This can be used to place

an upper limit on the eddy coefficient, and this limit is substantially below values frequently quoted on the basis of vapor or meteor trail studies. The upper limit is about 10^6 cm^2/sec above 80 km and about 4×10^5 cm^2/sec from 50 to 70 km. The fact that diffusive equilibrium distributions of atmospheric constituents prevail no lower than 105 km, where the molecular diffusion coefficient is 10^6 cm^2/sec, indicates that the eddy coefficient at that altitude has the limiting value indicated by the thermal structure. Author

13 HEAT TRANSFER AND THERMODYNAMICS

Includes ablation; cooling; heating; and other thermal effects. *For aerothermodynamics see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 03 Aerodynamics of Wings, Rotors, and Control Surfaces. *For combustion see*: 26 Propellants and Combustion. *For related information see*: 11 Fluid Mechanics.

N64-22931* National Aeronautics and Space Administration, Washington, D.C.
INVESTIGATION OF THE UPPER ATMOSPHERE BY THE SATELLITES, COSMOS-3 AND COSMOS-5 [ISSLEDOVANIYE VERKHNEY ATMOSFERY PRI POMOSHCHI SPUTNIKOV "KOSMOS-3" I "KOSMOS-5"]
Yu. I. Gal'perin and V. I. Krasovskiy Oct. 1963 12 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 1, no. 1, Jul.–Aug. 1963 p 126–131
(NASA-TT-F-8565)

A description is given of the equipment installed on Cosmos III and Cosmos V, including two traps for fast charged particles, five electron counters with fluorescent screens, and a Geiger counter. The charged particle traps registered the total current produced by the ion and electron fluxes, with energies exceeding a certain threshold value. G.D.B.

N64-22950* National Bureau of Standards, Boulder, Colo.
PRELIMINARY THERMODYNAMIC PROPERTIES OF NEON
R. D. Mc Carty and R. B. Stewart Reprinted from Advances in Cryogenic Engineering, v. 9 N.Y., Plenum Press, 1964 p 161–167 Presented at the Cryogenic Eng. Conf., Colorado U., Boulder, 19–21 Aug. 1963
(NASA Order R-45)

Pressure, density, and temperature measurements were made on neon at cryogenic temperatures and at high pressures. Fixed points of neon, the equation of state and its coefficients, the vapor-pressure equation, PVT deviations, and a graphic description of derived properties, such as entropy, internal energy, and enthalpy, are given. D.E.W.

N64-22975 Battelle Memorial Inst., Columbus, Ohio
MULTIFUELED THERMAL-ENERGY-CONVERSION SYSTEMS Quarterly Progress Report, 1 Jan.–31 Mar. 1964
H. R. Hazard and J. D. Hummell [1964] 22 p
(Contract DA-36-039-SC-90838)
(Rept.-7; AD-601419)

The study of small steam boilers of minimum size and weight for a solid-fuel-fired power source was continued. Control problems were solved by developing a natural-circulation boiler having considerable water and steam storage, and satisfactory operation was demonstrated. An available ultrasonic atomizer proved to be too large for a multifuel liquid-fuel burner. Development of a much smaller atomizer is in progress. Author

N64-23134 Michigan U., Ann Arbor
THREE-PHASE AC ARC HEATER Final Technical Documentary Report, 1 May–15 Nov. 1963
R. Phillips, D. Geister, P. Handy, and S. Bowen Wright-Patterson AFB, Ohio, ARL, Feb. 1964 147 p refs
(Contract AF 33(657)-8630)
(ARL-64-29; AD-601240)

Experimental and theoretical investigations into the technology associated with three-phase a.c. arc heaters is presented and critically discussed. The behavior of the three-phase arc is extensively considered, and it is shown that a previously reported analysis can adequately predict this behavior. The problems of designing arc-heater components are discussed and, in particular, those associated with the pressure vessel. The present low-pressure chamber extracts an unacceptable amount of energy from the arc-heated gas resulting in a rather low unit efficiency. The benefits that might result from coupling a magnetogasdynamic accelerator to the arc heater for flight simulation are discussed, and on the basis of perfect accelerator performance (no losses), significant increases in stagnation properties can be effected. Author

N64-23165 National Bureau of Standards, Boulder, Colo. Cryogenic Engineering Lab.
THERMODYNAMIC PROPERTY VALUES FOR GASEOUS AND LIQUID CARBON MONOXIDE FROM 70 TO 300°K WITH PRESSURES TO 300 ATMOSPHERES
J. G. Hust and R. B. Stewart 30 Nov. 1963 113 p refs
(NBS-TN-202)

The internal energy, entropy, enthalpy, and density of carbon monoxide are tabulated as functions of pressure and temperature from 70° to 300° K and 0.1 to 300 atm. A compressibility factor–pressure chart and a temperature–entropy chart are also included. The P-ρ-T values have been calculated using the Su principle of corresponding states with nitrogen as a model. Extensive comparisons are included that illustrate the deviations of the calculated values from the experimental data and from other correlated data. Equations representing the P-ρ-T surface and the vapor pressure are given. Author

N64-23201 Marquardt Corp., Van Nuys, Calif.
THE PROBLEM OF ACCURACY MEASURING CHANGING TEMPERATURES OF NON-METALLIC SURFACES
Samuel Sklarew [1964] 28 p refs Presented at the 8th Refractory Composites Working Group Meeting, 14-16 Jan. 1964

Emittance, while simple in concept, is difficult to measure under dynamic and changing conditions. In this paper, the importance of instrument calibration is discussed, and several devices for calibration are described. Techniques developed for obtaining effective emittance, effective true temperature, hemispherical, and spectral emittances, as well as true temperature, also are described and discussed. The specifications for a needed pyrometer system, presently unavailable, are detailed. Author

N64-23266* National Aeronautics and Space Administration. Ames Research Center, Moffet Field, Calif.

THE AERODYNAMIC HEATING OF ATMOSPHERE ENTRY VEHICLES—A REVIEW

H. Julian Allen [1964] 44 p refs Presented at the Symp. on Fundamental Phenomena in Hypersonic Flow, Cornell Aeron. Lab., Buffalo, 25–26 Jun. 1964

(NASA-TM-X-54056) OTS: $4.60 ph

A ballistic vehicle attaining the range of one-quarter the earth's circumference must be accelerated during the boost phase into space at a speed of about 7 km/sec. The vehicle then has a kinetic energy of about 25 × $10^6 m^2/sec^2$ per unit mass, about eight times the amount of energy required to convert a unit mass of ice into steam. If a large fraction of this kinetic energy must be converted into heat, only a small fraction of it can be allowed to heat the vehicle if it is not destroyed before reaching the target. This paper analyzes the problems created by these physical laws. G.D.B.

N64-23317 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

AN INVESTIGATION OF WETTING OF THE SOLID SURFACES OF CERTAIN HIGH-MELTING COMPOUNDS BY MOLTEN METALS

V. N. Yeremenko and Yu. V. Naydich (Acad. Sci. Ukr. SSR) *In its* Transactions of the Seminar on Heat-resistant Materials 1959 p 1–22 refs (See N64-23316 16-01)

The general nature of the process of the wetting of solid surfaces by liquid metals (influence of temperature and time) was studied, and the relationship between wettability and other properties of the materials (of the pair coming into contact) was investigated. The wettability of oxides increases with conductivity, and oxides with high conductivities are thoroughly wetted by liquid metals. An explanation is given for wetting processes and a calculation of the interphase surface energy shown. Carbide–metal and boride–metal systems are considered in particular. P.V.E.

N64-23359 Little (Arthur D.) Inc., Cambridge, Mass.

CONTAMINANT FREEZE-OUT IN HEAT EXCHANGERS. VOLUME II —BASIC INVESTIGATION OF CONTAMINANT FREEZE-OUT Final Report, Apr. 1962–Jun. 1963

R. B. Hinckley, J. C. Burke, F. E. Ruccia, R. P. Berthiaume, R. C. Reid et al Wright-Patterson AFB, Ohio, ASD, Jul. 1963 361 p refs

(Contract AF 33(657)-8695)

(ASD-TDR-63-508, Vol. II; AD-418144)

An analytical and experimental program to investigate the principle mechanisms of water and carbon dioxide freeze-out and to develop analytical methods for predicting the effects of contaminant deposition on heat exchanger performance has been conducted. A test facility was constructed incorporating a glass-walled test heat exchanger section to permit visual and photographic observation of frost formation, together with measurements of the effect of the frost on heat transfer and pressure drop. Several parameters that might affect the deposition rate of contaminants, such as carrier stream pressure, flow rate, water and carbon dioxide content, coolant temperature, and gas-to-wall temperature difference, were varied during these studies to permit evaluation of their contribution to the problem. Tube diameters and tube spacings in the test section were varied to investigate the effects of heat exchanger geometry. Nucleation of the contaminants in the inlet airstream was promoted to observe the effect of impingement of particles in the heat exchanger. In parallel with the experimental effort, analytical studies of the mechanisms of mass transfer and nucleation were conducted and the relative importance of these mechanisms compared. Author

N64-23360 Little (Arthur D.) Inc., Cambridge, Mass.

CONTAMINANT FREEZE-OUT IN HEAT EXCHANGERS. VOLUME III —CONTAMINANT FREEZE-OUT TEST DATA Final Report, Apr. 1962–Jun. 1963

R. B. Hinckley, J. C. Burke, F. E. Ruccia, R. P. Berthiaume, R.C. Reid et al Wright-Patterson AFB, Ohio, ASD, Jul. 1963 380 p

(Contract AF 33(657)-8695)

(ASD-TDR-63-508, Vol. III; AD-418070)

As part of an analytical and experimental study of water and carbon dioxide freeze-out in heat exchangers, a test program was conducted covering a wide range of airstream pressures, temperatures, mass flow, and concentration conditions. The test program consisted of 42 tests, grouped by objective into five test series. This volume presents the detail test data obtained in the test program. The test data include mass flow rates, heat balances, contaminant concentrations at the heat exchanger inlet and outlet, notes on the deposit appearance, and tabulations of heat exchanger pressures and temperatures as functions of time and position for each test. In addition, brief summaries of the data obtained in each test series are included. Author

N64-23404 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

LONGITUDINAL FLOW AROUND A HEATED CYLINDER OF A HIGHLY VISCOUS LIQUID

A. Sh. Asaturyan and B. A. Tonkoshkurov 23 Oct. 1962 9 p refs Transl. into ENGLISH from Inzh. -Fiz. Zh. (USSR), v. 3, no. 7, 1960 p 106–111

(FTD-TT-62-1333/1+2; AD-290831)

The heat exchange on the the surface of a cylinder with a liquid flow directed along its axis is discussed. Nondimensional values are given for an axially symmetrical boundary layer at longitudinal nonisothermal flow around a cylinder. G.D.B.

N64-23471 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

STABILITY OF A CIRCULAR CYLINDRICAL ENVELOPE IN A NON-UNIFORM TEMPERATURE FIELD

V. V. Kabonov *In its* News of Schools of Higher Education Aeronautical Engineering 1 Mar. 1963 p 1–9 refs (See N64-23470 16-01)

An investigation is made of the linear problem of the local stability of a circular cylindrical envelope in a nonuniform temperature field. It is noted that within the limits of the linear theory of stability of thin-walled envelopes, the nonuniformity in the distribution of forces in a cross section of the envelope has practically no effect on the critical value of the largest compressive force. Bilging of the envelope along short longitudinal waves occurs when the largest compressive force has reached the value of the critical force in uniform compression. J.R.C.

N64-23488 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

AN APPROXIMATE SOLUTION TO A TWO-DIMENSIONAL STATIONARY HEAT-CONDUCTION PROBLEM AND ITS USE IN THE DETERMINATION OF THE EFFECT OF ARTIFICIAL COOLING OF TURBINE COMPONENTS

D. A. Pereverzen (Acad. Sci. Ukr. SSR) *In its* Heat Power Engineering 14 Feb. 1963 p 1–19 refs (See N64-23487 16-01)

Certain generalized solutions to the problem of a stationary temperature field in a semibounded body with internal cylindrical heat sources and approximate solutions to problems with

boundary conditions of the third type are given. The equations derived were used to calculate the effect of cooling a turbine drum rotor. Author

N64-23492 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CALCULATION OF NON-STATIONARY TEMPERATURE FIELDS OF A STRUCTURE WITH CONSIDERATION OF THE HEAT RADIATION DURING NON-STEADY FLIGHT PROGRAMS
E. Tyan-Tsi *In its* News of Schools of Higher Education, Aeronautical Eng. 27 Mar. 1963 p 1–13 refs (See N64-23491 16-01)

The nonstationary temperature fields in an aircraft structure are examined. The effect of heat radiation is taken into consideration, and practical method of calculating the fields is presented. P.V.E.

N64-23530* National Beryllia Corp., Haskell, N.J.
RESEARCH ON LOW-DENSITY THERMAL INSULATION MATERIALS FOR USE ABOVE 3000°F First Quarterly Status Report, Jan. 1–Mar. 31, 1964
K. H. Styhr [1964] 25 p refs
(Contract NASw-884)
(NASA-CR-56546) OTS: $2.60

Composite refractory materials for use as high-temperature thermal insulation are being developed and evaluated. The mechanism under investigation is the attenuation of the radiation component of thermal conductivity by the incorporation of radiation barrier phases into a foamed ceramic matrix. Specimens containing metallic tungsten or molybdenum thermal radiation barrier phases have been shown to be superior thermal insulators compared with unimpregnated ceramic foams. Author

N64-23610* National Aeronautics and Space Administration. Marshall Space Center, Huntsville, Ala.
THERMAL INTERFACE CONDUCTANCE IN A VACUUM
Harry L. Atkins and Erwin Fried (GE) N.Y., AIAA [1964] 24 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun. – 2 Jul. 1964
(AIAA Paper-64-253)
AIAA: $0.50 members, $1.00 nonmembers

This presentation discusses the problem in general, drawing on existing work in vacuum and in the presence of gases. Results of a literature survey are presented, and the various prediction methods are discussed. A proposed approach to thermal conductance prediction, with concurrent experimental program and experimental results, is presented in detail. Conclusions and recommendations for further work are included. G.D.B.

N64-23633 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THERMODYNAMIC ANALYSIS AND HEAT CALCULATION OF A HIGH-VELOCITY CYLINDRICAL LRE COMBUSTION CHAMBER
G. B. Sinyarev *In its* Certain Probl. of Mech. 28 Aug. 1963 p 40–67 refs (See N64-23629 16-01)

The improvement of methods of carburetion, an increase in the pressure in the combustion chamber, together with an attempt to decrease its weight, and an increase in the thrust of single chambers of LRE have created a noticeable increase in the flow intensity of LRE combustion chambers. This is analyzed and calculated. G.D.B.

N64-23686 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EXPERIMENTAL INVESTIGATIONS OF SPINNING DETONATION BY MEANS OF PIEZOELECTRIC GAUGES
M. Ye. Topchiyan *In its* J. of Appl. Mech. and Tech. Phys. 10 Sep. 1963 p 18–32 refs (See N64-23864 16-11)

The construction of the piezoelectric gage agrees basically with the diagram given. The gage consists of a barium titanate plate of 1-mm diam and 0.5-mm thickness soldered with Wood's alloy on a long zinc tube of the same diameter. The measurements were carried out in the propagating wave. Special care was taken to avoid acoustic distortions arising in the detonation tube in such a way that its surface did not protrude into the inner surface of the tube. G.D.B.

N64-23689 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
LOCAL-MONODIMENSIONAL DIFFERENCE SCHEMES ON NONUNIFORM
A. A. Samarskiy *In its* Journal of Computer Mathematics and Mathematical Physics 22 Nov. 1963 p 1–50 refs (See N64-23688 16-23)

Local monodimensional methods for obtaining numerical solutions of a linear equation of heat conduction are presented. The methods use arbitrary irregular grids for linear and quasi-linear parabolic equations with the "heat conduction coefficient" assumed to be dependent upon the "temperature." The discussion is divided as follows: (1) local monodimensional schemes of variable directions on an irregular grid; (2) a priori evaluations; (3) convergence and accuracy on nonuniform grids; and (4) addition problems. P.V.E.

N64-23898 Hokkaido U., Sapporo (Japan) Inst. of Low Temperature Science
INTERNAL FRICTION OF ICE. PART I: THE INTERNAL FRICTION OF H_2O AND D_2O ICE, AND THE INFLUENCE OF CHEMICAL IMPURITIES ON MECHANICAL DAMPING
Daisuke Kuroiwa 1964 65 p refs *Its* Contribution no. 660; Ser. A, No. 18

The internal friction of pure H_2O, D_2O ice and contaminated ice crystals containing various chemical impurities such as NaCl, HCl, NaOH, HF and NH_4F were measured, between 0° C and – 180° C, by the flexural vibration method. The following results were obtained: (1) In pure H_2O and D_2O ice, a typical relaxation curve was observed showing the same value for the activation energy (13.1 kcal/mole) as for the dielectric relaxation. (2) In doped ice crystals, the activation energy was reduced to about half of the pure ice value. (3) Another damping maximum due to aggregated impurities appeared around – 145° C in NaCl- and HCl-doped ice. (4) This maximum decreased with annealing. (5) Fluoride-doped ice crystals also exhibited an annealing effect on the relaxation curve. Author

N64-23965 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE EFFECT OF MIXING OF A MATERIAL IN A FLUIDIZED BED UPON HEAT TRANSFER BETWEEN A GAS AND PARTICLES
A. P. Baskakov 1 Mar. 1963 13 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 3, no. 9, 1960 p 10–16
(MCL-1289/1+2+4; AD-299628)

The effect of the degree of mixing of a material upon the average temperature difference between it and a pseudoliquefying agent (a gas) is examined. A conclusion is made about the ideal (in practice) mixing of a fluidized bed in industrial apparatus, and also about the impossibility of obtaining a

countercurrent scheme in a fluidized bed on a single-hearth furnace, regardless of the place of introduction of the material. Author

N64-24001 Space Technology Labs., Redondo Beach, Calif. Physical Research Div.
RESEARCH ON LOW TEMPERATURE COMPUTING ELEMENTS
H. T. Mann and R. B. Muchmore Mar. 1964 55 p refs
(Contract Nonr 2542(00))
(Rept.-8971-6009-RU-000; AD-436035)

A review of current progress in research on superconducting computing devices is presented. The review discusses work in the following areas: (1) cryotron studies—cryotron matrix evaporation, masks, electron guns, large circuits cryostats; (2) indium gate films; (3) electron decomposition of metal bearing compounds; and (4) polymer dielectric films—low voltage resistance, rate equations. Also included with the report is a paper on the superconductivity of highly agglomerated indium films. In the paper, the conductive properties of indium films vacuum deposited at room temperature were examined in a shielded cryotron configuration for thicknesses up to 10,200 A and temperature down to 2.90° K. P.V.E.

N64-24050 Air Force Systems Command, Wright-Patterson AFB, Ohio Research and Technology Div.
CONDENSATION HEAT TRANSFER. PART III: THEORY OF LIQUID METAL CONDENSATION Technical Documentary Report, Apr.–Nov. 1963
John Lee Mar. 1964 25 p refs
(ASD-TDR-62-1048, Pt. III; AD-436350)

Turbulent film condensation for liquid metals was investigated using both Nusselt's model and the two-phase model. The effect of turbulent transport was expressed by the eddy kinematic viscosities of Deissler and von Kármán. The predictions of the average heat-transfer coefficient are higher than the liquid metal data of Misra and Bonilla. However, under the premise that there is an upward vapor flow, it is shown qualitatively that an upward vapor flow can greatly reduce the heat transfer coefficient. The observed scatter of data may be attributable to the variations of vapor velocity. Author

N64-24097 Colorado U., Boulder
DEVELOPMENT OF FILM TYPE 2000° F HEATERS
Frank C. Walz Wright-Patterson AFB, Ohio, ASD, Mar. 1964 29 p refs
(Contract AF 33(616)-6810)
(ASD-TDR-62-662; AD-435786)

This report describes the research performed in the development of 2,300° F "evac-plated" heaters formed on plasma-flame-sprayed dielectric substrates of alumina. This report also describes the research performed in the development of 2,000° F film-type heaters processed entirely by plasma-flame-spraying techniques. These heaters will withstand 10 heating cycles to 2,000° F with 10 minutes at 2,000° F each cycle, and can handle power input densities of 100 kw/ft^2. Author

N64-24106* IIT Research Inst., Chicago, Ill.
RADIATIVE ENERGY TRANSFER ON ENTRY INTO MARS AND VENUS Quarterly Report No. 6
William O. Davies Oct. 1963 28 p refs
(Contract NASr-65(01))
(NASA-CR-56554; IITRI-T200-6) OTS: $2.60 ph

The dissociation rate of carbon dioxide has been determined for temperatures from 3,500° to 6,000° K. The rate of disappearance of carbon dioxide behind shock waves in CO_2-N_2 and CO_2-Ar gas mixtures was monitored by observing the radiation from the CO_2 4.3μ fundamental vibration band. The dissociation rates obtained for 1% CO_2 in both argon and nitrogen were fit to the classical collision theory for diatomic molecules, yielding the rate constants. Author

N64-24156 Owens-Illinois Technical Center, Toledo, Ohio
THE AXIAL THERMAL EXPANSION OF TETRAGONAL ZIRCONIA BETWEEN 1150° AND 1700°C
S. M. Lang Wright-Patterson AFB, Ohio, Office of Aerospace Res., Apr. 1964 26 p refs
(Contract AF 33(616)-7470)
(ARL-64-63; AD-442281)

Within the accuracy and precision limits of the diffraction measurements, the calculated lattice constants were the same for the three source materials but only after each had been subjected to a prior heat-treatment at 1,550° to 1,750° C in a normal barometric air atmosphere. The thermal expansions of the two axes are linear within the temperature range investigated and are given by the following equations: a-value = $3.588_2 + 4.50 \times 10^{-5}$(T), within 0.001_3 A; and c-value = $5.188_2 + 7.57 \times 10^{-5}$(T), within 0.002_2 A, where T is in °C for the range between 1,150° C and 1,700° C. These, probably, also apply for temperatures up to at least 2,000° C. The lattice constants are a = 3.639_9A and c = 5.275_3 A at 1,150° C and a = 3.678_2 A and c = 5.339_7 A at 1,700° C. It was necessary to redetermine the axial expansions of BeO. Equations are given. Author

N64-24178 Aro, Inc., Arnold Air Force Station, Tenn. Aerospace Environmental Facility
TEMPERATURE EFFECTS ON THE CAPTURE COEFFICIENTS OF SIX COMMON GASES
J. P. Dawson Arnold Eng. Develop. Center, May 1964 45 p refs
(AF 40(600)-1000)
(AEDC-TDR-64-84; AD-600146)

The effects of gas and cryosurface temperature on the capture coefficient of six gases are discussed. The gas temperature effect is interpreted by the critical velocity model, and the cryosurface temperature effect is qualitatively explained by the potential field model. The possible error involved when these results are extrapolated to higher gas temperatures is also discussed. Experimental results are presented for the cryopumping rates of nitrogen, argon, carbon monoxide, nitrous oxide, oxygen, and carbon dioxide over 10° to 25° K cryosurfaces and a gas temperature range of from 77° to 400° K. Author

N64-24182 Lexington Labs., Inc., Cambridge, Mass.
THERMAL RADIATION CHARACTERISTICS OF TRANSPARENT, SEMI-TRANSPARENT AND TRANSLUCENT MATERIALS UNDER NON-ISOTHERMAL CONDITIONS Technical Documentary Report, May 1961–Jun. 1962
Robert C. Folweiler Wright-Patterson AFB, Ohio, Res. and Technol. Div., Apr. 1964 26 p refs
(Contract AF 33(616)-8368)
(ASD-TDR-62-719; AD-690370)

Thermal radiation from refractory oxide materials is a volume, rather than a surface, phenomenon. General equations describing emissivity, transmissivity, and reflectivity for scattering and absorbing systems have been derived in a form that allows determination of the necessary material constants and calculation of emissivity under isothermal and nonisothermal conditions. Methods of evaluating conditions under which these equations are applicable have been derived, and a simple

expression developed for radiant energy transfer when conduction in the solid is negligible relative to the radiant energy transfer in the solid. Experimental apparatus has been developed and measurements of the isothermal emissivity of several refractory oxides and the transmissivity of single crystals have been made over the wavelength range 1–15 microns at temperatures up to 1,350° C. Diffuse transmissivity measurements provided experimental values from which scattering was calculated for each sample. Large scattering values (100–1000 cm^{-1}) were obtained; however, emissivities calculated from these measurements agreed well with experimentally measured data. Author

14 HUMAN BEHAVIOR

Includes crew training and evaluation; piloting; and psychological factors. *For simulators see*: 10 Facilities, Research and Support. *For related information see*: 16 Life Sciences.

N64-22936* National Aeronautics and Space Administration, Washington, D.C.

PROVISION FOR RADIATION SAFETY DURING THE FLIGHTS OF "VOSTOK-3" AND "VOSTOK-4" [OBESPECHENIYE RADIATSIONNOY BEZOPASNOSTI PRI POLETAKH KORABLEY "VOSTOK-3" I "VOSTOK-4"]

V. V. Antipov, Yu. I. Yefremov, M. D. Nikitin, I. A. Cavenko, and P. P. Saksonov Feb. 1964 8 p refs Transl. into ENGLISH from Kosmich. Issled., (USSR), v. 1, no. 2, 1963 p 303–308

(NASA-TT-F-8823)

Data are presented on the radiation environment in cosmic space before and during the group flight of the satellites Vostok 3 and Vostok 4, piloted by astronauts A. G. Nikolayev and P. R. Popovich. The characteristics of cosmic radiation are presented briefly. A description is given of the principal measures taken to provide for radiation safety during the group cosmic flight. Author

N64-22937* National Aeronautics and Space Administration, Washington, D.C.

THE DOSE OF COSMIC RADIATION IN THE BIOLOGICAL UNITS OF THE "VOSTOK-3" AND "VOSTOK-4" SPACECRAFT [DOZA KOSMICHESKOY RADIATSII V BIOBLOKAKH KOSMICHESKIKH KORABLEY "VOSTOK-3" I "VOSTOK-4"]

V. N. Lebedev, V. S. Morozov, G. F. Murin, M. D. Nikitin, and M. I. Salatskaya 1964 6 p refs Transl. into ENGLISH from Kosmich. Issled., (USSR), v. 1, no. 2, 1963 p 309–311

(NASA-TT-F-8824)

The dose of cosmic radiation was measured in special biological units of the Vostok 3 and Vostok 4 spacecraft by nuclear emulsions of type R and K, a scintillation photodosimeter, and X-ray film of type XX. As a result of these measurements, the total dose of cosmic radiation during the flight of Vostok 3 was 41 ± 6 millirads, and during the flight of Vostok 4 it was 30 ± 4 millirads. Author

N64-22941* National Aeronautics and Space Administration, Washington, D.C.

REACTION OF THE HUMAN AND ANIMAL CARDIOVASCULAR SYSTEM UNDER CONDITIONS OF WEIGHTLESSNESS [REAKTSIYA SERDECHNO-SOSUDISTOY SISTEMY CHELOVEKA I ZHIVOTNYKH V USLOVIYAKH NEVESOMOSTI]

R. M. Bayevskiy and O. G. Gazenko 1964 17 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 2, no. 2, 1964 p 307–319

(NASA-TT-F-8895)

Data are presented on the cardiovascular system, which were obtained during the flights of the second and third Vostok satellites. Reactions of the circulatory system were found to have a phase quality. Changes in cardiovascular function may be caused by decreased demands made by the body on the cardiovascular system under the conditions of weightlessness and by changes in nervous regulation. The data indicate that the level of myocardial function is lowered and that asynchronism develops in the activity of the right and left halves of the heart. It is concluded that the tone of the parasympathetic division of the autonomic nervous system increases during weightlessness. A discussion of the significance of blood circulation research in insuring the safety of spaceflights is included. Author

N64-23365 Lockheed Missiles and Space Co., Sunnyvale, Calif.

IONIZING RADIATION EFFECTS ON PERFORMANCE CAPABILITIES OF ASTRONAUTS: AN ANNOTATED BIBLIOGRAPHY

Eugene E. Graziano, comp. Nov. 1963 41 p refs

(SRB-63-13)

This selective bibliography consists of 82 references to literature specifically relating to ionizing radiation effects on human space travelers. Immediate and long-range effects on the eyes, and other tissues vital to optimum performance capabilities, were of special interest; antiradiation drugs were also of interest. The period covered in the search was from January to November 1963. Author

N64-23608* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

TOLERANCE TO VEHICLE ROTATION OF SUBJECTS USING TURNING AND NODDING MOTION OF THE HEAD WHILE PERFORMING SIMPLE TASKS

Ralph W. Stone, Jr. and William Letko New York, AIAA, [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, Washington, 29 Jun.–2 Jul. 1964

(AIAA Paper-64-218) AIAA: $0.50 members, $1.00 nonmembers

Turning and nodding motions by astronauts in flight, while performing simple tasks, may cause great discomfort. The relationship of acceleration and vehicle rotation to head and body motions creates problems that are discussed in the report. G.D.B.

N64-23609* National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Tex.

THE PILOT'S ROLE DURING MERCURY SYSTEMS FAILURES

John H. Boynton N.Y., AIAA [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, Washington, 29 Jun.–2 Jul. 1964

(AIAA Paper-64-222) AIAA: $0.50 members, $1.00 nonmembers

The critical system failures that occurred during the manned orbital flights are examined with regard to the pilot's response and effectiveness in coping with hazardous situations. Mercury missions are discussed in relation to the astronaut's responsibilities. Although the Mercury spacecraft was designed

for completely automatic or remote control of all normal mission events, a careful analysis clearly indicated the importance of the pilot's role. G.D.B.

N64-23617 Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Research Inst.
STUDIES OF AIR LOADS ON MAN
John J. Swearingen and Ernest B. Mc Fadden May 1963 10 p refs
(CARI-63-9)

Data obtained in three different studies related to measurement of forces on the body due to air movement are summarized. The effects of short duration blast forces on personnel seated or standing at various distances from openings during pressure loss, blast forces necessary to disorient the body from numerous positions, effects of clothing on the drag forces, and measurements of forces and moments on the body during wind-tunnel tests are discussed and compared. Author

N64-23639 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MAN BEFORE LAUNCHING INTO SPACE
Ye. Yugov and A. Serov *In its* Stations in Space 10 Feb. 1964 p 22–28 (See N64-23634 16-01)

The medical and biological problems of space flight are considered, with special emphasis placed upon weightlessness. Data were obtained from the first Soviet space flights. A.W.

N64-23650 Marquardt Corp., Van Nuys, Calif.
SURVEY OF CONTROLLED TETHERING SIMULATION TECHNIQUES
Jun. 1964 14 p
(MP-1266)

With the proposed tethering system, information on position, velocities, and accelerations is obtained at the spacecraft to provide performance information on the worker–machine combination. System qualification on Gemini should demonstrate the utility of controlled tethering systems on future projects. This survey describes various feasible simulation techniques and explores those techniques that appear most practical. J.R.C.

N64-23993* Space Technology Labs., Inc., Redondo Beach, Calif.
STUDY OF MODEL MATCHING TECHNIQUES FOR THE DETERMINATION OF PARAMETERS IN HUMAN PILOT MODELS. REPORT ON TASK 2, LINEAR, TIME-VARIANT MODELS
G. A. Bekey, R. E. Rose, and H. F. Meissinger 20 Nov. 1963 62 p refs
(Contract NAS1-2582)
(NASA-CR-56374; Rept.-8426-6003-RU-000) OTS: $6.60 ph

The initial phase of the study is aimed at an improvement of convergence time of the continuous model matching technique developed previously. The dependence of convergence time on the choice and composition of the criterion function, on parameter adjustment gain, and on filtering in the adjustment loop is studied. Results obtained in this phase are used in matching artificially perturbed parameters of a second-order system by adjusting the parameters of a second-order model. The original system is made time variant by perturbing its parameters sinusoidally or stepwise. The model matching technique is applied to the determination of parameters in a mathematical model of a human pilot engaged in performing a time-varying control task. Author

N64-24040* Space Technology Labs., Inc., Redondo Beach, Calif.
A STUDY OF MODEL MATCHING TECHNIQUES FOR THE DETERMINATION OF PARAMETERS IN HUMAN PILOT MODELS
G. A. Bekey, H. F. Meissinger, and R. E. Rose 2 May 1964 170 p refs
(Contract NAS1-2582)
(NASA-CR-56362; Rept.-8426-6006-RU000) OTS: $12.00 ph

This report presents the results of a study of techniques for the determination of parameters in mathematical models of the human pilot. The study departs from conventional approaches because the pilot is characterized by transfer functions or quasi-linear describing functions, progressing into the domain of time-variant and nonlinear operations and representative models of this type. The final portion of the study is concerned with manual tracking in two axes—the operator is modeled as a multiple input–multiple output system. Emphasis was placed primarily on development of computational methods; model matching experiments on synthetic pilots with known parameters were required. The resulting methodology was successfully applied to actual pilot tracking data and provided new insight into the pilot's dynamic response. The experimental results are presented in the report. A part of the study was devoted to the comparison of continuous and iterative parameter adjustment methods. In addition, significant analytical results were derived pertaining to the nature of parameter optimization by the gradient method. The report concludes with a recommendation of areas for further study of mathematical pilot models. Author

N64-24064 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROBLEM OF ELECTRONARCOSIS AND ELECTRO-SLEEP
Z. Servit and Ya. Burets, et al 13 Feb. 1964 21 p refs Transl. into ENGLISH from Chekhoslovatskaya Fiziol. (USSR) v. 2, no. 4 1953 p 337–346
(FTD-TT-63-931/1+2; AD-435500)

Continuous galvanic current can produce electronarcosis (galvanonarcosis) only among lower vertebrates. Among higher vertebrates (mammals), continuous galvanic current produces a narcotizing effect only in combination with a proper pharmacological narcotic. Author

N64-24092 Harry Diamond Labs., Washington, D.C.
PROTECTION OF THE HUMAN EYE FROM LASER RADIATION
Harold W. Straub 10 Jul. 1963 11 p refs
(TR-1153; AD-436705)

Various possibilities for protecting the human eye from blinding through laser radiation were considered. Of the investigated selectively absorptive and/or selectively reflective (dielectric) optical filters, some have to be disregarded for a variety of reasons. The Schott BG-18 type filter glass, in a thickness of approximately 4.3 mm, appears to provide adequate protection in the low and medium energy pulse range and in a spectral range between 0.69 and 1.2μ, covering the ruby as well as the Nd-doped glass and Ca WO_4 lasers. The calculations are based on the assumption of equality of the burn sensitivities of the human and of the rabbit retina. Author

N64-24119* Columbia U., New York, N.Y. Legislative Drafting Research Fund
SOME MAJOR HAZARDS IN GOVERNMENT SPONSORED ACTIVITIES

Menelaos D. Hassialis, Robert I. Bernstein, and Lawrence H. O'Neill Jan. 1964 143 p refs
(Contract NASr-181)
(NASA-CR-56623) OTS: $11.00 ph

This report contains nine chapters as follows: (1) Summary; (2) Introduction; (3) Space Vehicle Systems; (4) Missiles; (5) Nuclear Engines and Weapons; (6) Chemical Hazards; (7) Military Aircraft; (8) Weather Control Experimentation; and (9) Bacteriological and Biological Hazards. A.W.

N64-24234 Utah U., Salt Lake City
VARIABLES RELATED TO ACCURACY IN INTERPERSONAL PERCEPTION Final Report
Victor B. Cline and James M. Richards, Jr. Jan. 1964 31 p refs
(Contract Nonr-19288(04))
(AD-436402)

In order to test for significant differences among the incentive conditions that were used to influence judgment of interpersonal perception, a simple analysis of variance was computed. Results are presented in tabular form. It was found that none of the differences in response are significant and that varying the incentives for accurate judgment did not have any reliable effect upon accuracy. These results were the opposite of what had been predicted. (It had been predicted that a variation in incentives would have some effect on accuracy of interpersonal perception.) R.T.K.

15 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; sensors and transducers; and telescopes and cameras. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; and 22 Navigation and Guidance.

N64-22753* Yale U. School of Medicine, New Haven, Conn.
[CONDUCT RESEARCH ON GAS CHROMATOGRAPHIC SYSTEMS TO ANALYZE CERTAIN CHEMICAL CONSTITUENTS OF THE SURFACE OF THE MOON] Progress Report, 1 Aug. 1961 through 31 Jan. 1963
S. R. Lipsky [1963] 5 p refs
(Grant NsG-192-61)
(NASA-CR-50183) OTS: $1.10 ph

The development of a suitable gas chromatographic detection system which will be capable of determining the presence of organic compounds on the surfaces of the Moon and Mars is discussed. A simple and highly sensitive system was developed for the analysis of both gases and organic vapors. The detector, containing a 200 mc tritium source, is an ionization chamber characterized by a low internal volume and concentric electrodes 1 mm apart. The limit of detection approached 10^{-12} moles per second per 25 ml of carrier gas. P.V.E.

N64-22763* California U., Berkeley Space Sciences Lab.
DETECTION AND STUDY OF MICROORGANISMS IN THE UPPER ATMOSPHERE Progress Report
William J. Oswald et al 3 Apr. 1963 25 p refs *Its* Series 4; Issue 26
(Grant NsG-104-61)
(NASA-CR-50261) OTS: $2.60 ph

Research progress has been made in the following areas: (1) refinement and modification of electrostatic precipitator configuration; (2) generation of test aerosols; (3) study of electrical characteristics of the electrostatic precipitator under low air density conditions; (4) design of flight sampler; and (5) development of bacteriological techniques. Author

N64-23008 Utah U., Salt Lake City Upper Air Research Labs.
AEROSPACE VEHICLE DETECTION STUDIES Program Progress Report, 1 Dec. 1963–29 Feb. 1964
Obed C. Haycock [1964] 49 p refs Prepared in Cooperation with Utah State U.
(Contract AF 04(695)-339)
(AD-433859)

CONTENTS:

1. A FIELD SPECTROGRAPH FOR HIGH RESOLUTION SPECTRAL ANALYSIS OF ROCKET PLUME W. K. Barlow 12 p (See N64-23009 16-15)
2. THE SCANNING FABRY-PEROT INTERFEROMETER AS A DETECTOR OF OPTICAL RADIATION W. L. Jones (Utah State U.) 11 p refs (See N64-23010 16-15)
3. SATELLITE RECOGNITION BY INTERFEROMETRIC MEANS R. G. Layton 10 p refs (See N64-23011 16-15)
4. SATELLITE INDUCED RADIATION BY O^+ RECOMBINATION A. M. Despain 10 p (See N64-23012 16-28)

N64-23009 Utah U., Salt Lake City
A FIELD SPECTROGRAPH FOR HIGH RESOLUTION SPECTRAL ANALYSIS OF ROCKET PLUMES
Wayne K. Barlow *In its* Aerospace Vehicle Detection Studies [1964] 12 p (See N64-23008 16-15)

Grating spectrographs of the Rowland type are to be used in recording highly resolved spectral data obtained from rocket plumes. The objective of recording the visible region spectral characteristics of typical rocket boosters is to determine what changes may occur in the plume radiation spectrum as the vehicle approaches burnout altitude. A spectrographic system to be used in the field is being developed. P.V.E.

N64-23010 Utah State U., Logan
THE SCANNING FABRY-PEROT INTERFEROMETER AS A DETECTOR OF OPTICAL RADIATION
William L. Jones *In its* Aerospace Vehicle Detection Studies [1964] 11 p refs (See N64-23008 16-15)

Because of its large light-gathering capacity, its compact size, and other advantages, the scanning Fabry–Perot interferometer holds considerable promise for use as a detector of optical radiation. Although closely spaced orders of interference may overlap in a Fabry–Perot spectrometer, this problem is alleviated if the detected radiation is of simple spectral composition. If this is not the case, an interference filter may precede the Fabry–Perot interferometer, or two scanning Fabry–Perot interferometers could be used in tandem. Author

N64-23011 Utah U., Salt Lake City
SATELLITE RECOGNITION BY INTERFEROMETRIC MEANS
R. Gary Layton *In its* Aerospace Vehicle Detection Studies [1964] 10 p refs (See N64-23008 16-15)

A method that can be used to determine satellite shapes when they are at or near the limit of resolution of an optical

system is discussed. The method considers using the information that can be obtained by observing interference phenomena and their relation to the source. P.V.E.

N64-23087 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTRONIC DIFFERENTIAL SYSTEM FOR AUTOMATICALLY MEASURING THE RATE OF ROLLING
P. I. Dekhtyarenko, S. F. Kozubovskiy, A. M. Meleshev, and S. R. Raykhman *In its* Automation 14 Feb. 1963 refs p 74–82 (See N64-23080 16-17)

The mode of operation of a correlation metering device for measuring the rate of metal rolling machines is described. Two points of the metal strip are illuminated by two sharp luminous dots that are a fixed distance apart. During the movement of the metal strip, the brightness of the dots varies with structural heterogeneities. The images of the lines are detected by two photomultipliers with an output consisting of an electric signal proportional to the brightness of the lines. The amplified signals are fed to a correlator having an output signal that is maximum in the case when the transportation lag of the metal passing between the two points is equal to the control lag. The control lag block is calibrated directly in rate values, so the magnitude of the introduced lag can be used as a measure of the rate of rolling. M.P.G.

N64-23091 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
OPTIMUM SPEED REGULATOR OF RIVER BOATS
O. F. Chernish *In its* Automation 14 Feb. 1963 refs p 96–102 (See N64-23080 16-17)

The development of an optimum speed indicator and regulator for river boats is reported. The regulator is based on an open-type-trouble-control system rather than on a feedback system; its basic advantage therefore, is rapid action because the inertia of the ship's body does not affect the system. An expression of the dependence of the optimum number of engine revolutions upon the depth of water in which the ship is traveling was used in designing the functional converter unit that controls the operating engines. M.P.G.

N64-23168 Defence Research Telecommunications Establishment, Ottawa (Canada) Communications Lab.
A VIDEO SIGNAL ENHANCER FOR USE WITH OBLIQUE-INCIDENCE IONOSPHERIC SOUNDERS
D. C. Coll and G. E. Poaps Jan. 1964 20 p refs
(DRTE-1127; AD-434874)

This report is concerned with a postdetection, RC, rangegate signal enhancer developed to improve the performance of oblique-incidence, sweep-frequency, ionospheric sounders. The enhancer utilizes the energy available from the multiplicity of sounding pulses that are transmitted on each frequency, together with the coherence of pulse-to-pulse amplitude, to increase the signal-to-noise ratio available to display devices. The limited number of pulses transmitted on each frequency restricts the effectiveness of the enhancer; however, its performance in the presence of wideband HF interference has been shown to be very good. Author

N64-23203 Air Force Systems Command, Bedford, Mass. Electronic Systems Div.
SUMMARY OF INVESTIGATIONS INTO INSTRUMENTATION CALIBRATION
Joseph J. Blum 31 Jan. 1964 75 p refs
(ESD-TDR-64-188; AD-436292)

Techniques and approaches to calibration of range instrumentation are investigated. Existing calibration techniques are examined in terms of accuracy, cost, and time. Results of a tradeoff study examining rocket and/or satellite methods of calibration are presented. Expressions for modeling systematic instrumentation errors are given. A scheme for satellite calibration of the global Satellite Control Facility, which would not require reliance on any external standard, is examined. N.E.A.

N64-23205* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Maryland
INSTRUCTION MANUAL. SIDEREAL RATE GENERATOR AND CLOCK
Raymond L. Granata and Paul Mc Caul May 1964 46 p
(NASA-TMX-55008; X-531-64-136) OTS: $4.60 ph

This manual provides a comprehensive technical description of the operating and physical characteristics of the sidereal generator. It outlines maintenance procedures and provides sufficient information concerning the functional theory of operation to permit intelligent and effective operation and maintenance of the unit. N.E.A.

N64-23230* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RECENT DEVELOPMENTS IN PRESSURE ALTIMETRY
William Gracey N.Y., AIAA [1964] 8 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-344) AIAA: $0.50 members, $1.00 nonmembers

Some of the more significant accomplishments of recent years relating to the improvement of instruments, the measurement and compensation of the errors of static-pressure systems, and the collection of information on the flight technical error are reviewed. Previous studies of the relation between altimetry errors and vertical separation standards are discussed, and the problem of assessing vertical separation standards is examined from an approach different from that used in those studies. Author

N64-23279 Lincoln Lab., Mass. Inst. of Tech., Lexington
CAMERA-OSCILLOSCOPE RECORDING EQUIPMENT FOR ATHENA PROGRAM RADARS
J. L. Warner 2 Dec. 1963 43 p ref
(Contract AF 19(628)-500)
(PA-3; AD-441684)

The camera–oscilloscope recording equipment photographs A-scope information plus auxiliary data at frame (pulse) rates of 25 to 120 frames per second with a resolution of 196 × 490 lines (vertically and horizontally) on 35-mm film. At 100 frames per second a 1,000 ft reel of 35-mm film produces about 160 sec of data. Author

N64-23301 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEW FAST CAMERA WITH SPHERICAL OPTICS
G. M. Popov 17 Apr. 1964 14 p refs Transl. into ENGLISH from Izv. AN SSSR, Krymskaya Astrofiz. Observ., v. 27, 1962 p 309–317
(FTD-MT-63-354; AD-409040)

A fast camera with a large field and slight losses, and scattering due to light is described. Formulas for computing the aberration are given. Various modifications of the camera system (achromatic and plane field) are discussed. Results of

the computation of 15 different schemes with different focal ratios and refractive indices are tabulated. The camera system can be used for the study of meteors, nebulae, zodiacal light, airglow, etc. The system can also be used as a camera in the field of spectrography. I.v.L.

N64-23304 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PRINCIPLES OF CONSTRUCTION OF RESONANT-CAVITY LEVEL GAGES
L. G. Palevich 14 Aug. 1963 13 p refs Transl. into ENGLISH from Priborostroenie (Moscow), no. 11, 1962 p 6–8
(FTD-TT-63-562/1+2+4; AD-421827)

A resonant-cavity method for measuring a level is proposed in which the metal walls of the vessel containing the liquid are used as the sensitive element. Special coupling elements in the form of a pole or loop antenna are placed in the vessel, and electromagnetic oscillations are induced as in a normal cavity circuit. The electromagnetic parameters of the fluid and the dimensions of the vessel must remain constant. In the resonant-cavity method the complex problem of contactless measuring is simplified and reduced to determining the resonant frequencies of the cavity circuit with the aid of the following radio-engineering devices and circuits: (1) frequency sensor and superheterodyne indicator; (2) circuit for automatically tuning a frequency to an extremum of the resonance curve; and (3) circuits without servosystems. E.K.R.

N64-23306 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MEASURING RANGE: FROM 0.4 TO 1,000,000 ROENTGENS PER MINUTE
N. Zukov 27 Mar. 1964 5 p Transl. into ENGLISH from Nauka i Zhizn' (USSR), no. 9, 1963 p 24–25
(FTD-TT-64-31/1+2; AD-439595)

This paper describes a glass vacuum chamber with aluminum electrodes that is capable of measuring X-ray radiation from 0.4 to 1,000,000 r. Its principle of operation is based on the capacity of solids to emit electrons when subjected to X-ray or radioactive radiation. E.K.R.

N64-23344* Michigan U., Ann Arbor
AN INFRARED INTERFERENCE SPECTROMETER —ITS EVALUATION, TEST, AND CALIBRATION
Lucien W. Chaney and Leslie T. Loh Washington, NASA, Jun. 1964 59 p refs
(Contract NASr-54(03))
(NASA-CR-61) OTS: $1.50

A Michelson interference spectrometer operating in the 2μ to 15μ spectral region is evaluated for its application to atmospheric radiation measurements. Two data reduction techniques were investigated. One method requires the calculation of the Fourier transform, using incremental sampling and a high-speed digital computer. The other method is based on the use of a standard wave analyzer and a loop tape recorder to make a Fourier series or harmonic analysis. The two methods are compared from the standpoint of error sources and ease of calibration. Several methods of calibrating wavelength and amplitude are investigated. The final results are given by presenting the equivalent blackbody temperature measurements of a blackbody at several known temperatures. Author

N64-23375 Advisory Group for Aeronautical Research and Development, Paris (France)
DEVELOPMENT OF A SIMPLE RUNWAY WAVINESS MEASURING SYSTEM
F. J. Plantema and J. Buhrman Oct. 1963 48 p refs In ENGLISH; FRENCH Summary
(AGARDograph-80)

A review is given of the work concerned with surface waviness of runway and taxi-tracks. The collection of statistical data and the advantages and disadvantages of various forms of presentation of these data are discussed. Runway roughness criteria are dealt with briefly. A discussion is given of the shortcomings of existing systems and methods for measuring the range of wavelengths from 4 ft to 200 ft. An optical system that avoids these shortcomings is described. The results of a series of test runs with the NLR-system are compared with the results of conventional level-and-rod measurements. The agreement between the derived characteristics (power spectrum and deviations from straight lines) is very satisfactory. The agreement between the runway profile as obtained by integration of the measured slopes and the true profile is limited, since the system gives a true reproduction of the components in the design range of wavelengths. It is concluded that the NLR-system shows favorable characteristics as a rapid and simple measuring system. A few current and possible future extensions of the work are dealt with briefly. Author

N64-23383 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AIRCRAFT GYROSCOPES (SELECTED PARTS)
G. O. Firdlender and M. S. Kozlov 20 May 1963 20 p refs Transl. into ENGLISH from the Book "Aviatsionnyye Giroskopicheskiye Pribory" Moscow, Gos. Nauchno-Techn., Izd., Oborongiz, 1961 p 175–197, 243–377
(FTD-TT-62-1560/1+2; AD-413521)

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4. GYROSCOPIC POWER SYSTEMS p 107–141 (See N64-23387 16-15)
5. GYROSCOPIC SYSTEMS UNPERTURBED BY INERTIA p 142–196 refs (See N64-23388 16-15)

N64-23384 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AVIATION DIRECTIONAL GYROSCOPE
G. O. Firdlender and M. S. Kozlov *In its* Aircraft Gyroscopes (Selected Parts) 20 May 1963 p 1–30 (See N64-23383)

Aviational directional gyroscopes are discussed in terms of the free gyroscope and its behavior in accordance with the geographical latitude at which it is situated. The principal underlying designs for directional gyroscopes are presented. Construction of two directional gyroscopes is described. Possible errors in directional gyroscope readings are considered. G.D.B.

N64-23385 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HIGH-SPEED GYROSCOPES
G. O. Firdlender and M. S. Kozlov *In its* Aircraft Gyroscopes (Selected Parts) 20 May 1963 p 31–91 (See N64-23383 16-15)

High-speed gyroscopes are discussed in terms of principles, calculations, and types—high-speed frame, high-speed accelerating, vibration, 3° high speed, and electric EUP-53 turn indicator. G.D.B.

N64-23386 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INTEGRATING GYROSCOPES
G. O. Firdlender and M. S. Kozlov *In its* Aircraft Gyroscopes (Selected Parts) 20 May 1963 p 92–106 (See N64-23383 16-15)

Integrating gyroscopes are explored from the aspects of working principle, characteristics, use in stabilized platforms, and calculations. G.D.B.

N64-23387 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
GYROSCOPIC POWER SYSTEMS
G. O. Firdlender and M. S. Kozlov *In its* Aircraft Gyroscopes (Selected Parts) 20 May 1963 p 107–141 (See N64-23383 16-15)

The theory and working principles of gyroscopic power stabilization systems are presented. The construction of twin- and triple-gyroscope central gyrovertical devices is discussed. G.D.B.

N64-23388 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
GYROSCOPE SYSTEMS UNPERTURBED BY INERTIA
G. O. Firdlender and M. S. Kozlov *In its* Aircraft Gyroscopes (Selected Parts) 20 May 1963 p 142–196 refs (See N64-23383 16-15)

A general discussion of gyroscopic systems unperturbed by inertia is presented. The simulation of an undisturbed physical pendulum by means of gyroscopes is examined. Methodical errors in inertial gyroverticals are discussed, as well as errors due to deviation of the earth's shape from a sphere. The effect of applied disturbing moments on behavior of the gyrovertical is included, along with the effect of inaccuracy on maintaining coefficient and angular momentum. G.D.B.

N64-23410 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
GYROSCOPE DRIFT CAUSED BY FRICTION OF THE GIMBAL BEARINGS AND REDUCTION OF THIS DRIFT BY THE USE OF ROTATING BEARINGS
Ye. M. Rodionov 4 Mar. 1963 18 p ref Transl. intb ENGLISH from the Book "Nekotoryye Vprosy Sovremennoy Tekhnologii, Priborostroyeniya", Tr. Inst., no. 52, Oborongiz, Moscow, 1961 p 33–44
(FTD-TT-62-1900/1+2+4; AD-400509)

This article is devoted to considering one of the causes of unsteady drift—the rolling-resistance moments of the gimbal bearings. An evaluation is given of the effectiveness of methods of reducing the drift by oscillatory rotations of the gimbal bearings. G.D.B.

N64-23411 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SOME SPECIAL MEASUREMENTS OF MAGNETIC DENSITY
A. A. Braude 20 Feb. 1963 20 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 13, no. 6, 1962 p 832–841
(FTD-TT-63-1/1+2+4; AD-299651)

A method is described for measuring magnetic density with a ballistic galvanometer by means of the action of a variable field on the ferromagnetic specimen. The parameters of the experimental setup, the examples of the method's use in investigating ideal curves of magnetization, and the effect of creep are presented. Author

N64-23417 General Dynamics/Convair, San Diego, Calif. Electronics Research Labs.
AN OPTICAL INTERFEROMETER FOR DIRECTION MEASUREMENT
R. A. Thiel 8 May 1961 21 p refs
(ERR-AN-050)

The basic principles of direction measurement using interferometric techniques, and the applications of these techniques to space velocity measurements are discussed. A type of interferometer capable of accomplishing such a measurement is proposed, and a basic sensitivity is calculated and compared to the sensitivity obtainable with conventional telescope techniques. It is concluded that an interferometer can be built having a sensitivity of 0.01 sec of arc or better. However, except for very high sensitivities (>> 0.01 sec) there is little to recommend the interferometer over the telescope. Author

N64-23439 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MINIATURE PHOTOGRAPHIC APPARATUS
D. Bunimovich 17 Dec. 1963 4 p Transl. into ENGLISH from Novyye Tovary (Moscow), no. 7, 1959 p 6
(FTD-TT-63-1073/1; AD-430242)

A description is given of a miniature photographic apparatus. The apparatus is intended for unperforated film 16 mm wide. The film holder holds a film 45 cm in length on which can be obtained 20 frames of the dimensions 10 mm × 14 mm (smaller than a postage stamp). The objective of the apparatus is set at a constant focus, and has measuring exposures of 1/30, 1/60, and 1/200 sec. The apparatus was intended primarily for outdoor pictures, but indoor pictures are possible because of high sensitivity of the film. A.L.B.

N64-23445 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A THERMOCHEMICAL GAS ANALYZER FOR CONTINUOUS DETECTION OF OXYGEN
G. P. Tsyplyatnikov and V. B. Aleskovskiy 8 Jan. 1963 18 p refs Transl. into ENGLISH from Izvest. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. (Moscow), v. 3, no. 3, 1960 p 550–559
(FTD-TT-62-1554/1+2+4; AD-295776)

A working model of a thermochemical gas analyzer for continuous detection of oxygen in gaseous mixtures containing up to 10% O_2 was constructed and tested under laboratory conditions. The action of the gas analyzer is based on using the relationship of the emf of a platinum and iridium platinum thermocouple, on which flameless hydrogen combustion occurs at a temperature in the gaseous medium of 250° to 300°, because of the oxygen in the gas to be analyzed to the oxygen concentration. The research data may be used for developing an automatic gas analyzer for continuous detection of oxygen directly in a stream of hot gas. Author

N64-23541 Joint Publications Research Service, Washington, D.C.
INVESTIGATING THE EFFECT OF MANEUVERING AN OBJECT ON A GYROPENDULUM EQUIPPED WITH CORRECTORS
M. M. Bogdanovich *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 79–85 refs (See N64-23532 16-01) OTS: $3.00

This article deals with the effect of using a gyropendulum equipped with correctors in maneuvering an object. Author

N64-23542 Joint Publications Research Service, Washington, D.C.
CONCERNING THE MOTION OF FREE GYROSCOPE WITH UNIFORMLY ROTATING BASE
N. V. Butenin and Ya. L. Lunts *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 86–96 refs (See N64-23532 16-01) OTS: $3.00

Under investigation is the motion of a free gyroscope set deliberately on a uniformly rotating base. Due to the inertness of the Cardan rings, the axis of the figure does not maintain the fixed direction in inertial space. Equations are derived for determining the error of the gyroscope. Author

N64-23544 Joint Publications Research Service, Washington, D.C.
ABOUT ONE METHOD OF REGULATING THE MOVEMENT OF CLOCKS
A. D. Romanov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 109–116 refs (See N64-23532 16-01) OTS: $3.00

This article describes a method for regulating the precision of balance-type of timepieces; the method is based on creating an additional moment for the hair spring by shifting its external end. There are experimentally obtained curves for the relative change of the period during the free attenuations of the balance, using different hair springs. There are examples of designing devices for shifting the stem of hair springs and how to use them for different time instruments. Author

N64-23545 Joint Publications Research Service, Washington, D.C.
CONCERNING THE IMAGE INCLINATION AND ROTATION IN OPTICAL INSTRUMENTS
G. V. Pogarev *In its* News of Higher Educational inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 117–126 refs (See N64-23532 16-01) OTS: $3.00

Equations are derived for calculating the values of the angle of inclination and the angle of deflection of images, which take place during the adjustment and turning of mirror and prism systems. Solutions of practical examples are given for finding the allowable tolerances for such defects. Author

N64-23549 Joint Publications Research Service, Washington, D.C.
TELEVISION UNIT WITH MEMORY TUBE FOR PRODUCTION OF CLICHE
G. N. Gryazin *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 157–159 ref (See N64-23532 16-01) OTS: $3.00

A television unit, using a memory tube as the analyzing element, can be successfully employed in production of typographic printed forms. The entire system consists of two independently operating parts: (1) an analyzing and recording device; and (2) an actuating device. J.R.C.

N64-23886 Electro-optical Systems, Inc., Pasadena, Calif.
STUDY OF METEOROLOGICAL INSTRUMENTATION AND TELEMETRY SYSTEMS SUITABLE FOR 70-150 km ALTITUDE Final Report, 14 Feb.–25 Mar. 1963
Glenn Cato, D. Marlow, J. Miller, C Skinner, and L. Snyder 25 Mar. 1963 73 p refs
(Contract N123(61756))
(EOS-3800, Pt. I; AD-601483)

On the basis of this study, these instruments were selected for consideration as to their value in rocket probe systems: the density spectrophotometer, the supersonic pitot tube, the high-altitude pitot tube, the ionization gage, the Langmuir probe, the ozone spectrophotometer, and the water vapor spectrophotometer. Composite payloads consisting of combinations of complementary instruments are defined. A.W.

N64-23902* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HORIZON SENSING FOR ATTITUDE DETERMINATION
Barbara K. Lunde Washington, NASA, Jun. 1964 17 p refs Presented at the Goddard Mem. Symp. of the Am. Astronautical Soc., Washington, D.C., 16–17 Mar. 1962
(NASA-TM-X-956) OTS: $0.50

This report discusses the horizon scanners used in determining the angles between the direction to the center of a body in space and the axes of a spacecraft. Several satellites have used various types of horizon sensors for attitude determination. For example, Tiros satellites and Explorer XVII (1963 9A) used passive scan; Mercury capsules have used conical scan. It is planned that the Orbiting Geophysical Observatory, Nimbus, Gemini, and Apollo programs will include horizon scanners. A scanner accuracy within 1° to 2° was obtained for earth scanners. These errors were caused by the radiation pattern of the earth. Data on that pattern for various wavebands are included. Author

N64-23915 United Electrodynamics, Inc., Pasadena, Calif.
CONCEPTS FOR ON-STRUCTURE SHEAR GAGE AND ON-STRUCTURE SELF-RECORDING STRESS GAGE Final Report
S. R. Stagner and R. Obenchain Kirtland AFB, N. Mex., AF Special Weapons Center, Aug. 1963 91 p refs
(Contract AF 29(601)-4366)
(AFSWC-TDR-62-148; AD-422753)

Various concepts for the measurement of normal and tangential loads at the buried structure–soil medium interface are described. The concepts are evaluated in the light of basic criteria for load measuring devices, accuracy, and reliability under the anticipated testing environments and projected cost. Among the concepts explored are gages based on piezoresistivity, optical effects, magnetic effects, and brittle coatings. Preliminary designs for a peak normal load magnetic gage and a variable reluctance shear gage are presented. Author

N64-23927 New York U., N.Y. School of Eng. and Sci.
ON THE SYNTHESIS OF THRESHOLD DEVICES
Philip Kaszerman Sep. 1963 135 p refs
(Grant AF-AFOSR-62-152; AF-AFOSR-24-63)
(TR-400-84; AFOSR 64-0394; AD-437294)

A Boolean function of *n* variables is defined as a mapping

from the vertices of an *n*-dimensional hypercube to (TRUE, FALSE). A threshold function is defined as a Boolean function whose TRUE vertices are separable from the FALSE vertices by a hyperplane. Comparison is made between a threshold function and the set of points on the surface of the hypersphere that lie on the TRUE side of the hyperplane. The concept of a "region of vertices" is introduced. Functions generated by a two-threshold-device network are examined. A nonlinear summation threshold device is fully described, and a map method for threshold functions is developed. A.W.

N64-23939* Michigan U., Ann Arbor
[LABORATORY AND FLIGHT TESTING OF RADIATION MEASUREMENTS] Fourth Quarterly Status Report, 1 Nov. 1963–31 Jan. 1964
8 Apr. 1964 5 p refs
(Contract NASr-54(03))
(NASA-CR-56207; Rept.-05863-4-P) OTS: $1.10 ph

The following are discussed: (1) laboratory testing of radiation measuring instruments; (2) aircraft flight tests of NIMBUS MRIR and HRIR radiometers; (3) analysis of data obtained on previous balloon flights; (4) preliminary planning for the next balloon flight; (5) study of methods of analysis of data on the "Kaplan" experiment, and (6) study of stellar refraction as a meteorological satellite technique. R.T.K.

N64-24002 France. Office National Detudes et de Recherches Aeronautiques, Chatillon-sous-Bagneux
LIMITATIONS OF SOLAR COLLECTORS FOR ENERGY CONVERTORS [LIMITATIONS DES COLLECTEURS SOLAIRES POUR CONVERTISSEURS D'ENERGIE]
Felix Trombe and Emile Le Grives (Centre Natl. de la Rech. Sci.) [1964] 51 p refs Presented at the Sixth AGARD Colloquium on Combustion and Propulsion, Cannes, France 16–20 Mar. 1964 In FRENCH
(ONERA-TP-100)

A study of the different space systems using solar energy and of the technological difficulties associated with each is presented. The major problems are as follows: (1) the construction of rigid yet lightweight collectors; (2) the deployment of these structures from a small-volume package; (3) the concentration of solar rays with a high efficiency by a receptor of the appropriate shape; and (4) precise orientation of the collector with respect to the sun. It is concluded that the structural rigidity required by the high source temperatures associated with the efficient concentration of solar rays is not presently compatible with engines of the scale of hundreds of kilograms or more. However, if the optical precision required for deployable collectors can be accomplished in the next few years, multiple applications of solar energy converters are forseen in the fields of propulsion and telecommunications. M.P.G.

N64-24043* Honeywell, Seattle, Wash. Aeronautical Div.
ATMOSPHERIC COMPOSITION INSTRUMENTATION Final Report
J. E. Crowley, J. G. Ballinger, and H. M. Hoeksema 30 Nov. 1962 42 p refs
(Contract NAS7-100; JPL-950285)
(NASA-CR-56453; Rept.-2928-TRI) OTS: $4.60 ph

A study is carried out to define the upper and lower bounds of frost point and atmospheric temperature in the atmosphere of Mars to establish the dynamic range requirements for instrumentation. The temperature and frost point of the atmosphere of Mars indicate that a maximum temperature differential between the thermocooler hot and cold junctions of 91°C permits measurements of frost point at all extremes predicted for Mars. The developed instrument is capable of achieving a temperature differential of 90°C. J.R.C.

N64-24081* Los Alamos Scientific Lab., N. Mex.
RESPIRATOR DRYING CABINET
Earl J. Cox 22 Jun. 1964 9 p
(Contract W-7405-ENG-36)
(LAMS-3090) OTS: $0.50

In the routine decontamination of respirators, space limitations required some type of cabinet drying apparatus. A survey of commerical units revealed no satisfactory solution. A locally fabricated unit, meeting all requirements, is described. Author

N64-24157 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEW WARES Selected Articles
7 Jan. 1964 5 p Transl. into ENGLISH from Novyye Tovary (USSR), no. 8, 1959 p 4
(FTD-TT-63-1074/1; AD-430033)

A description is presented of an MIR 35-mm camera and three telephoto lenses (Telemar-22, Tair-11, and Yupiter-6). The MIR can be set at five shutter speeds (1/30, 1/60, 1/125, 1/250, and 1/500) and for time exposures. The MIR has a range finder and can be equipped with two different lens. The Yupiter-6 lens has a focal distance of 180 mm, a relative aperture of 1:2.8, and focuses within the range of 2 meters to infinity. The Telemar-22 has a focal distance of 200 mm, a relative aperture of 1:5.6, and focuses over the range 2.5 meters to infinity. The Tair-11 has a focal distance of 133 mm and a relative aperture ratio of 1:2.8. P.V.E.

N64-24183 Hydraulic Research and Mfg. Co., Burbank, Calif.
RESEARCH AND DEMONSTRATION OF A DIGITAL FLIGHT CONTROL SYSTEM ELECTRO-HYDRAULIC SERVO CONTROL VALVE–ACTUATOR EXPERIMENTAL MODEL Technical Documentary Report, Apr. 1962–Jun. 1963
D. S. Seidel Wright-Patterson AFB, Ohio, Res. and Tech. Div., May 1964 141 p refs
(Contract AF 33(657)-8644)
(RTD-TDR-63-4240; AD-601597)

This report discusses the applicability of various electrohydraulic servovalve (and servoactuator) configurations for use in digital flight-control systems. The research and developmental effort was conducted in five phases—initial research and analysis, interface study, choice of experimental model configuration, experimental model design analysis, and experimental model physical design and evaluation. Author

N64-24194 Solid State Radiations, Inc., Los Angeles, Calif.
A HIGH ENERGY PROTON SPECTROMETER UTILIZING SEMICONDUCTOR DETECTORS FOR SPACE PHYSICS EXPERIMENTATION Technical Documentary Report, 1 Jun. 1962–31 Dec. 1963
Henry S. Katzenstein and Frank P. Ziemba Wright-Patterson AFB, Ohio, AF Materials Lab., Apr. 1964 70 p
(Contract AF 33(616)-8340)
(ML-TDR-64-1; AD-600156)

High-energy protons are found in primary cosmic radiation, in the Van Allen belt, and in solar flares. A study of the best

methods of observing these phenomena, using a semiconductor nuclear particle detector technique developed previously, has resulted in three basic designs for proton spectrometers for space radiation measurements: (1) the single-detector with pulse height analysis; (2) a wide-angle proton spectrometer; and (3) a high-angular-resolution proton spectrometer. Of these three designs, the third was selected as being capable of providing the best quality of information within the existing state-of-the-art. A design for a 10-channel spectrometer covering the energy range from 24 to 210 Mev in approximately equal logarithmic steps was completed, and on the basis of this design, fabrication was undertaken on an actual prototype spectrometer. Author

N64-24197 Air Force Cambridge Research Labs., Bedford, Mass. Upper Atmosphere Physics Lab.

ION DISSOCIATION IN THE DRIFT TUBE OF A TIME-OF-FLIGHT MASS SPECTROMETER: V: ANALYTIC SOLUTIONS OF THE FLIGHT-TIME SHIFT EQUATION

W. W. Hunt, Jr. and M. J. Kennedy (Wentworth Inst.) Feb. 1964 11 p refs *Its* Phys. Sci. Res. Papers No. 3
(AFCRL-64-90; AD-601668)

Applying screened trapezoidal potential barriers in the drift tube of a time-of-flight (TOF) mass spectrometer produces flight-time shifts that can be used to separate and identify products of ion dissociation processes occurring between the ion source and the potential barrier. The flight-time shift is a function of the retarder voltage and mass-to-charge ratios of the fragment and parent ions, expressed by the flight-time shift equation. When the retarder voltage is known, analytic solutions of this equation allow the retarded ions (fragment or parent) to be identified from the measured flight-time shifts. When the mass-to-charge ratios of these ions are known, similar solutions allow the retarder voltage that will produce a given flight-time shift to be predicted. Author

N64-24199 Colorado U., Boulder Lab. for Atmospheric and Space Physics

THE THEORY, DESIGN AND DEVELOPMENT OF AN INTERFEROMETRIC SPECTROMETER Scientific Report No. 1 and 2, Jan. 1962–Jun. 1963

Richard Clayton Willson 1 Jul. 1963 87 p refs
(Contracts AF 19(604)-7240; AF 19(628)-287)
(AFCRL-63-688; AD-417763)

A general introduction to the operation of interferometers and the way they are used to yield spectrometric data is presented. The theory of interferometric data acquisition and analysis is discussed in detail. Specific design problems encountered in adapting a Michelson interferometer to a rocket-based experiment are discussed, and their solutions are presented. The prospective research problem used as the design criterion is the measurement of the height profile (reemission rate versus altitude) and Doppler profile of the 6,300 A spectral Line of $[O_I]$ in the night sky airglow. Author

16 LIFE SCIENCES

Includes biology; exobiology; physiology; medicine; life support systems; radiation effects on biological systems; and space sickness. *For related information see*: 14 Human Behavior; and 28 Space Radiation.

N64-22728 Joint Publications Research Service, Washington, D.C.

USSR HEALTH PROTECTION DEVELOPMENTS

29 May 1964 28 p refs Transl. into ENGLISH from Gigiyena i Sanitariya (Moscow), no. 3, 1964 p 19–23, 56–58, 66–69, 83
(JPRS-24840; OTS-64-31366) OTS: $0.75

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3. PROTECTION OF PERSONS WORKING IN ADJACENT ROOMS AND THE NEIGHBORING POPULATION FROM RADIATION EMITTED BY GAMMA-THERAPEUTIC UNITS N. I. Zol'nikova, V. Ya. Golkov, A. N. Krongauz, and I. A. Pereslegin p 11a–15 refs (See N64-22731 16-16)
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6. CLARIFICATION OF TWO ASPECTS OF THE PROBLEM OF METHODS OF INDIVIDUAL DOSIMETRIC CONTROL I. D. Kamyshenko, I. B. Kenrim-Markis, V. Ya. Margulis, A. A. Moiseyev, and R. V. Muzykantov p 23–24 (See N64-22728 16-16)

N64-22729 Joint Publications Research Service, Washington, D.C.

THE USE OF BIOLOGICALLY ACTIVE SYNTHETIC COMPOUNDS TO RAISE THE THERMAL RESISTANCE OF THE ORGANISM

Ye. I. Kuznets and N. N. Suvorov *In its* USSR Health Protection Developments 29 May 1964 p 1–7 refs (See N64-22728 16-16). OTS: $0.75

Experiments designed to study the thermal resistance of organisms were conducted on white mice. The mice were placed in a heat chamber in which the temperature was 45° to 50° C and the relative humidity was 20%. It was found that multiple injections of betazine and joint single injection of cystamine and AET (aminoethylisothiuronium bromide hydrobromide) increase the thermal resistance of white mice and, therefore, their survival time. R.T.K.

N64-22730 Joint Publications Research Service, Washington, D.C.

ON THE METHOD OF MEASURING OVERALL VIBRATIONS

V. M. Skornetskiy and P. S. Mironov *In its* USSR Health Protection Developments 29 May 1964 p 8–11 (See N64-22728 16-16) OTS: $0.75

Large displacement vibrographs (VBK and VEGIK) were used to register overall vibrations of the floor of the cab of a heavy dump truck and of the operating platform of a percussion-cable drilling unit. The operating principles of these vibrographs are presented, and the displacement-rate oscillograms obtained while using them to measure vibrations in the truck and drill are included. R.T.K.

N64-22731 Joint Publications Research Service, Washington, D.C.

PROTECTION OF PERSONS WORKING IN ADJACENT ROOMS AND THE NEIGHBORING POPULATION FROM RADIATION EMITTED BY GAMMA-THERAPEUTIC UNITS

N. I. Zol'nikova, V. Ya. Golikov, A. N. Krongauz, and I. A. Pereslegin *In its* USSR Health Protection Developments 29 May 1964 p 11a–15 refs (See N64-22728 16-16) OTS: $0.75

Soviet GUT-So-400 gamma therapy units are sources of gamma radiation with an energy of about 1.25-million electron volts. A comprehensive study of the radiation emitted by these gamma-therapeutic units was made. It was found that with ordinary thickness of ceilings and floors (up to 50 cm of concrete) the gamma-radiation dose rate in rooms located above a GUT-So-400 treatment room can exceed the maximum permissible values. With conventional-treatment room dimensions (25 square meters), the radiation dose rate in rooms located next to the treatment room does not exceed the maximum permissible value with a wall thickness of at least 100 cm. The gamma-radiation dose rate on the hospital grounds 5 meters from the walls of a treatment room was found to depend on the height of the window placement and on the thickness of the exterior walls of the hospital. Measures that can be taken in order to provide safety for persons working in rooms adjoining the therapeutic, as well as to the public at large, are discussed. R.T.K.

N64-22732 Joint Publications Research Service, Washington, D.C.

CLARIFICATION OF TWO ASPECTS OF THE PROBLEM OF METHODS OF INDIVIDUAL DOSIMETRIC CONTROL

I. D. Kamyshenko, I. B. Kenrim-Markis, V. Ya. Margulis, A. A. Moiseyev, and R. V. Muzykantov *In its* USSR Health Protection Developments 29 May 1964 p 23–24 (See N64-22728 16-16) OTS: $0.75

The IFK and the ILK dosimeter are recommended for measuring weekly radiation doses from X-ray diagnosis and therapy. Dosimeters built on the principle of thermoluminescent glass can also be used. It is felt that in measuring radiation doses in both therapeutic and diagnostic X-ray offices, proper measures should be taken to compensate for, or eliminate, the energy dependence of these dosimeters, and special calibration of these instruments should be carried out as a preliminary measure. R.T.K.

N64-22742 Joint Publications Research Service, Washington, D.C.

STUDIES IN COLOR VISION

Ye. B. Rabkin and Ye. G. Sokolova 22 Jun. 1964 32 p Transl. into ENGLISH from Biol. i Med. (Moscow), 1964 p 1–32 (JPRS-25184; OTS-64-31533) OTS: $1.00

This book is concerned with contemporary presentations on physiology, pathology, and hygiene, relative to the influence of various colors of the visible spectrum on the human eye, and on man's central nervous system and psyche. It discusses the principles of creation of the optimum color medium for the preservation and improvement of the visual functions. Emphasis is placed on light and color in nature, the structure of the human eye, color vision and its disorders, and the hygiene of color vision (e.g., the optimum color for schools and factories). I.v.L.

N64-22744 Joint Publications Research Service, Washington, D.C.

***VESTNIK* OF USSR ACADEMY OF MEDICAL SCIENCES, VOL XIX, NO. 5, 1964**

A. A. Pokrovskiy et al 23 Jun. 1964 155 p refs Transl. into ENGLISH from Vestnik Akad. Med. Nauk SSSR (Moscow), v. XIX, no. 5, 1964 p 3–96

(JPRS-25241; TT-64-31554) OTS: $3.00

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N64-22752* National Research Corp., Cambridge, Mass.

EFFECTS OF SIMULATED SPACE ENVIRONMENTS ON THE LIABILITY OF MICROORGANISMS Quarterly Status Report, Jan. 16–Apr. 15, 1963

Norman S. Davis, Gerald J. Silverman, and Frank C. Benner (MIT) 9 May 1963 6 p

(Contract NASr-41)

(NASA-CR-50333) OTS: $1.10 ph

During this period of testing the viability of microorganisms in simulated space environments, the combined effects of thermal and ultrahigh vacuum exposure were studied in continuing experiments with organisms isolated from Mohave Desert soils. Studies of the combined effects of gamma radiation and ultrahigh vacuum on selected microorganisms were resumed in an improved vacuum system. The ultraviolet radiation system has been modified so that the intensity of the lamp output was reduced from 1000 to 60 microwatts per square centimeter, thereby permitting studies at lower ultraviolet intensities. N.E.A.

N64-22754* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CHEMICAL EVOLUTION AND THE ORIGIN OF LIFE

Cyril Ponnamperuma [1963] 16 p refs Submitted for Publication
(NASA-TM-X-54008)

The origin of life is discussed from the standpoint of the evolution of the inorganic, organic, and biological material necessary for the formation and support of living organisms. Taken into consideration is the chemical evolution of the elements of the periodic table from the primeval cloud of hydrogen gas by a series of reactions. These materials form the inorganic materials, which form the organic materials that compose living organisms. Because of the progressive series of change in this scheme, life is considered a special and very complicated form of the motion of matter. Life may then be considered as an inevitable process that must appear in the cosmos where conditions are favorable. Attention is directed toward the possibility of the existence of life somewhere in the universe other than earth. Experiments are discussed in which several constituents of the nucleic acid molecule have been synthesized, beginning with the primitive atmospheres. C.L.W.

N64-22755* Resources Research, Inc., Washington, D.C.
"GULLIVER", AN EXPERIMENT FOR EXTRATERRESTRIAL LIFE DETECTION AND ANALYSIS
Gilbert V. Levin, Allen H. Heim, M. F. Thompson, N. H. Horowitz (Calif. Inst. of Tech.), and D. R. Beem [1963] 14 p refs Presented at the COSPAR 4th Intern. Space Sci. Symp., Warsaw, 10 Jun. 1963
(Contract NASr-10)
(NASA-CR-55511) OTS: $1.60 ph

The Gulliver experiment will function in the following manner. At least two instruments, one a test and the other a control, will be incorporated into a capsule destined to land on Mars. Sealed ampoules contain the radioactive medium. When the capsule lands on Mars, squibs will fire the projectiles. Each will deploy a 25-foot-long retrieval line over the surface of the planet. The motor will then reel the line, together with adhering particulate matter, into an incubation chamber. After the line is retrieved, the incubation chamber will be sealed and the ampoule will be broken, releasing the radioactive medium into the line. If organisms are present on the soil particles and are able to metabolize any of the labeled substrates, radioactive gases which will be detected with a Geiger tube, will be produced. All data will be transmitted to Earth by radio. The production of a typical biological growth curve for the test instrument and a negative, or materially reduced, response from the control instrument, which contains a broad spectrum antimetabolite, will constitute evidence of microbial life on Mars. I.v.L.

N64-22756* Resources Research, Inc., Washington, D.C.
RADIOISOTOPIC BIOCHEMICAL PROBE FOR EXTRATERRESTRIAL LIFE Second Annual Progress Report to NASA
Gilbert V. Levin, Norman H. Horowitz, Allen H. Heim, and Mary-Frances Thompson 26 Mar. 1963 152 p
(Contract NASr-10)
(NASA-CR-55318) OTS: $11.50 ph

Extensive laboratory investigations and field testing were conducted. These tests further substantiated the feasibility of the principle on which Gulliver (radioisotopic biochemical probe for extraterrestrial life) is based. Biological and instrumentation studies were pursued concurrently and interdependently. Gulliver III exhibited omnidirectional capability, importance as an antimetabolite injection system, and usefulness for flushing. This is a better technique for deploying sample collection lines. G.D.B.

N64-22757* Florida State U., Tallahasee
[BIOSATELLITE PROJECT] Progress and Status Report on NASA Grant NsG-103-61, Sept. 1, 1962–Feb. 28, 1963
A. Gib De Busk 2 May 1963 3 p
(Grant NsG-103-61)
(NASA-CR-50046) OTS: $1.10 ph

"Preliminary breadboard" studies for a series of biosatellite flights have been initiated. Experiments to be included are: back mutation, "woodward" death, recessive lethal dosage, and inositoless death. Mutation frequencies, lethal effects, and physiological injury will be reported. Also included are: mutation studies with alpha particles, biophysical studies of *Neurospora crassa*, cytological studies of *Neurospora*, analog inhibition and permease studies, and subchromosomal mutation by U.V. treatment. D.E.R.

N64-22758* IIT Research Inst., Chicago, Ill.
LIFE IN EXTRATERRESTRIAL ENVIRONMENTS Quarterly Status Report, May 15–Aug. 15, 1963
Charles A. Hagen [1963] 16 p refs
(Contract NASr-22)
(NASA-CR-50934; IITRI-C194-10) OTS: $1.60 ph

Eighty-eight cultures of facultative anaerobic bacteria were obtained from 253 isolates from various California desert soils. The cultures are screened for survival in a simulated Martian environment. A nonsporeforming organism identified as *S. aurantiaca* demonstrated a high resistance to the simulated Martian environment, after 112 days' exposure. Initial screening tests indicated good survival of *Bacillus cereus var mucoides*; 37% of the cells were recovered as total count and the spore count increased 4.9 times after 28 days' exposure to the simulated Martian environment. J.R.C.

N64-22759* Armour Research Foundation, Chicago, Ill.
LIFE IN EXTRATERRESTRIAL ENVIRONMENTS Phase Report [Feb. 15, 1962 – Feb. 28, 1963]
Charles A. Hagen and Ervin J. Hawrylewicz 28 Feb. 1963 14 p
(Contract NASr-22)
(NASA-CR-50516; ARF-C-194-8) OTS: $1.60 ph

Two *aerobacter* cultures, ATCC 13048 and butanediol-producing ATCC 8724, were subjected to a simulated Martian environment for 28 days to determine their survival. At the end of 28 days, less than 1% of the cells survived in either of the cultures. A total of 235 representative microorganisms was isolated from five desert-soil samples. The isolates were recovered from the samples before exposure to the Martian environment and after exposure for 28 and 84 days. Members of genus *Bacillus* were the most frequently present in the soil samples. *Actinomyces* were found in fewer numbers, and, occasionally, *Micrococcus* and molds were present. With increased time in the Martian environment, there was a decrease in the number of *Actinomyces*. Two pure *Coccus* and two pure *Bacillus* cultures that were isolated from the desert-soil samples exposed to the Martian environment for 84 days were studied. The *Coccus* cultures were more resistant to inoculation-flushing procedures and to the simulated Martian environment than were the *Bacillus* cultures. Author

N64-22760* Melpar, Inc., Falls Church, Va.
RESEARCH ON DETECTION OF EXTRATERRESTRIAL LIFE BY ULTRAVIOLET SPECTROPHOTOMETRY Second Quarterly Progress Report, Apr. 1–30 Jun. 1963
Sol S. Nelson 1963 26 p refs
(Contract NASw-571)
(NASA-CR-50815) OTS: $2.60 ph

Absorption of a narrow region of the far ultraviolet by materials of biological origin was studied. The peptide bond was found to exhibit a characteristic absorption of ultraviolet light of 185 to 190 mμ. Absorption maxima between 185 and 190 mμ were found for phenyl alanine, tryptophan, tyrosine, serum albumin, and ribonuclease. In the case of the two proteins, the absorbancies were studied as a function of pH and were found to pass through a maximum at approximately pH 7. Absorption maxima at the wavelength of interest were not observed with glycine, alanine, or glycyl glycine. Author

N64-22761* Esso Research and Engineering Co., Linden, N.J.
DEVELOPMENT OF HYDROCARBON ANALYSES AS A MEANS OF DETECTING LIFE IN SPACE Quarterly Report
W. G. Meinschein 1 Jul. 1963 10 p refs
(Contract NASw-508)
(NASA-CR-50703) OTS: $1.10 ph

Gas chromatograms of alkanes obtained with Apiezon L-coated capillary columns apparently provide a means of "fingerprinting" mixtures of saturated hydrocarbons. Alkanes from bat guano and from a 60-million-year-old sediment both contain higher concentrations of even- than of odd-carbon number n-paraffins in the C_{11} to C_{20} range and higher concentrations of odd- than of even-carbon number n-paraffins in the C_{23} to C_{31} range. Fischer–Tropsch saturated hydrocarbons, on the other hand, show a systematic increase followed by a systematic decrease in concentrations of homologous alkanes. These concentrational changes can be explained by the loss of volatile components from an abiotic product in which the reaction equilibria led to a decrease in concentration of homologous hydrocarbons with increasing carbon number. Nonsystematic fluctuations in the concentration versus carbon number plots of homologous alkanes appear to be characteristic of biological alkanes of low as well as of high molecular weights. Components of the benzene extract of the Orgueil meteorite vary nonsystematically in concentration with changing carbon number. Author

N64-22764* California U., Berkeley Space Sciences Lab.
REFLECTION SPECTRA OF BIO-ORGANIC MATERIALS IN THE 2.5–4μ REGION AND THE INTERPRETATION OF THE INFRARED SPECTRUM OF MARS
D. G. Rea, T. Belsky, and M. Calvin [1962] 22 p refs
(Grant NsG-101-61)
(NASA-CR-50208) OTS: $2.60 ph

Infrared absorption bands have been observed on the Martian surface at 2710(3.69μ), 2793(3.58μ), and 2910 cm^{-1}(3.45μ); these bands fall in the region where organic molecules and some inorganic compounds absorb. Therefore, it is so indicated that carbohydrates, especially aldehydes, are present in large quantities on Mars. To ascertain this theory, infrared spectrometers are included in spacecraft experimental packages destined for Mars. Also, the arguments, pro and con, for the existence of life on Mars are given, and an explanation of the infrared appearance of the planet, based on the existence of volcanic ash and suitable winds, is treated. D.E.R.

N64-22767* Florida State U., Tallahassee Genetics Lab.
GENETIC STUDIES IN THE SPACE ENVIRONMENT, Final Summary Report
A. Gib De Busk [1963] 32 p refs
(Grant NsG-103-61)
(NASA-CR-55359) OTS: $3.60

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N64-22768* Yale U., New Haven, Conn.
COMBINED SEMI-ANNUAL STATUS REPORT, NOV. 1, 1961–OCT. 31, 1962 [DETERMINATION AND ANALYSIS OF THE PROPERTIES AND CHARACTERISTICS OF EXTREMELY SMALL FREE-LIVING AND SELF-REPLICATING CELLS]
Harold J. Morowitz [1962] 3 p ref
(Grant NsG-208-62)
(NASA-CR-50397) OTS: $1.10 ph

The objectives of this study are (1) a search for small microorganisms which would missed by the standard assay methods, and (2) the characterization of Pleuropneumonia-like organisms as examples of very simple cells (with a possible relationship to primitive cells). The organisms for study were collected from the following sources; estuarine, marine, and pond waters, arable soils, nasopharyngeal washings from individuals with upper respiratory diseases, and plant homogenates. Porous cellulose ester membranes were used in the primary isolation of the cells. After isolation or screening, the organisms underwent filtration before being innoculated on specially prepared media for characterization studies. Twenty filterable forms have been isolated from estuarine and marine waters. One filterable strain was obtained from soil and one from a plant homogenate. Fresh-water ponds failed to give filterable forms that could be subcultured. The remaining material sources gave no filterable forms. The growth medium for pleuropneumonia-like organisms still presents many problems, and efforts to simplify this medium are underway. N.E.A.

N64-22769* General Mills Inc., Minneapolis, Minn.
RESEARCH TO DETERMINE THE EXISTENCE AND IDENTITY OF VIABLE MICROORGANISMS IN THE STRATOSPHERE First Quarterly Status Report, Mar. 18–Jun. 18, 1963
V. W. Greene [1963] 3 p
(Contract NASw-648)
(NASA-CR-50698) OTS: $1.10 ph.

Arrangements for the first two spaceflights to determine the existence and identity of viable microorganisms in the stratosphere were completed. A launch and recovery of a four-stratosphere microorganism sampler payload, which reached an altitude of 90,000 ft, were made. There were mechanical malfunctions of the anticontamination locks of the samplers, which limited the validity of the biological data. Results of the experiment suggest that (1) the sterilizing and storage techniques prior to launch were statisfactory, (2) the concept of sampling during descent has been properly programed, and (3) the contamination controls designed for the program

will serve their purpose if there are no mechanical malfunctions. The samplers and instrument packs were recovered intact and are being prepared for another flight. N.E.A.

N64-22771* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A BIOLOGICAL SYNTHESIS OF SOME NUCLEIC ACID CONSTITUENTS

Cyril Ponnamperuma 1963 2 p refs Presented at the Conf. on the Origin of Prebiol. Systems, Wakulla Springs, Fla., 27–30 Oct. 1963

(NASA-TM-X-54021) OTS: $2.60 ph

The synthesis of the purines, pyrimidines, sugars, nucleosides, and nucleotides found in the nucleic acid molecule was investigated. The results are relevant to the problem of the origin of life, because the conditions of the reactions were aqueous and the concentrations of materials were very low; the sources of energy used are those most likely to have existed under primitive earth conditions. G.D.B.

N64-22772* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MORPHOLOGY AND CHEMISTRY OF MICROSPHERES FROM PROTEINOID

Richard S. Young [1963] 10 p refs Presented at the Conf. on the Origin of Prebiol. Systems, Wakulla Springs, Fla., 27–30 Oct. 1963

(NASA-TM-X-51514) OTS: $1.10 ph

This report describes the formation of microspheres made by boiling and cooling proteinoid solutions; they exhibit many of the behavioral characteristics of complex protein-like molecules that constitute "living matter," that is, organic compounds that are the fundamental building blocks of the component parts of living cells. G.D.B.

N64-22773* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PRELIMINARY INVESTIGATIONS IN THE USAGE OF GAS CHROMATOGRAPHY FOR THE DETECTION OF LIFE ON MARS

Vance I. Oyama [1963] 11 p refs Submitted for Publication

(NASA-TM-X-50806) OTS: $1.60 ph

A 0.010" capillary column 300 ft long, coated with diethylene glycol succinate polyester, was temperature programed for the analyses of some microorganisms isolated from soils in order to ascertain as many of the products of protein thermal decomposition as is possible with a single system. Results indicate that, under these reproducible conditions during linear temperature programing, the chromatographic peaks descriptive of the retention products occur with a periodicity common to all of the organisms. There are differences in peak height relative to adjacent peaks, but the chromatograms indicate that thermal decomposition products of microorganisms can be displayed in a fashion to show equivalence. The relative peak heights in each separate chromatogram show differences and may indicate differences in the relative amounts of the precursor organic substance. Also a pyrolyzate chromatogram of crystalline bovine albumin, under similar conditions, was made. Similar patterns, corresponding to early appearing chromatographic retention times of the microorganisms, were reproduced. Thus, similar patterns for proteins, whether they be of plant or animal origin, seem to exist. I.v.L.

N64-22774* Stanford U., Calif. School of Medicine

AN INSTRUMENTATION CRISIS IN BIOLOGY

Joshua Lederberg May 1963 9 p

(Grant NsG-81-60)

(NASA-CR-51095) OTS: $1.10 ph

The inadequacy of the current art in biochemical instrumentation was brought to light by efforts to meet the requirements of exobiological studies. An immense amount of information is still locked up in spectra (optical absorption, magnetic resonance, rotary dispersion, mass spectra) and similar "fingerprints," which require the intensive development of the "man-computer x symbiosis" for adequate resolution. Digital computation may help answer the needs of the biochemist in regard to instrumentation. Precision can be improved in data-processing links as an inherent virtue of a digital system. Precision is also very often a signal-to-noise problem, and an ideal instrument should have the flexibility to allow accuracy to be achieved at the price of speed, in accordance with local needs. The memory capacity of the computer for averaging over a period of time and the use of correlation techniques to extract signals from noisy outputs suggest the application of simple computer techniques to improve the utility and to simplify the design of such workaday instruments as the absorption spectrophotometer. Probably more important is the construction of prototypes of new instruments by programing a general-purpose computer to set up the control and signal processing systems, instead of de nova construction. Time-sharing and the LINC computer systems will be investigated in the light of alleviating the instrumentation crisis in the area of biochemistry and in the area of particle counting which is the fundamental measurement in many aspects of microbiology and cytology. I.v.L.

N64-22775* Florida State U., Tallahassee Inst. for Space Biosciences

[RESEARCH IN SPACE BIOLOGY AND RELEVANT PHYSICAL ASPECTS OF PLANETARY AND SPACE ENVIRONMENTS] Semiannual Research Status Report

S. Fox, S. Hess, and C. Metz 1 May 1963 11 p

(Grant NsG-173-62)

(NASA-CR-50483)

The following results were obtained from investigations in space biosciences: (1) Studies on the thermal copolymerization of cystine with other amino acids reveal that cystine can form many other amino acids, aspartic acid being quantitatively prominent among these. (2) Thermal proteinoids were further characterized through improvements of the Akabori hydrazinolysis method. These studies show that proteinoids tend to have 2-4 C-termini per N-terminus which indicates a degree of branching comparable to that found in proteins. (3) The catalytic activity for *p*-nitrophenyl acetate of the proteinoids is found to a considerable degree in the thermal copolymers of a few amino acids, such as aspartic acid and histidine. (4) Evidence was obtained spectrally for the binding of hemes by proteinoid. (5) The active site of hydrolytic enzymes was synthesized. (6) Preparations of the thermal polymer of cytidylic acid are found to be attacked by ribonuclease. (7) The simultaneous polymerization of Leuchs anhydrides of the amino acids, common to protein, was accomplished and simplified. (8) A theoretical model of the general circulation of Venus in the deep layers of the atmosphere was formulated. (9) The first conception of a frost-point hygrometer to be dropped into the atmosphere of Mars was proved feasible. (10) Two clones of callus cells from *Haplopappus gracilis* were grown on a simple mineral-sugar-vitamin-agar medium through 13 subcultures. (11) A study of the pachytene and metaphase in the corresponding allotetraploid of an F, intergeneric hybrid, *Lycopersicon esculentum* X *Solanum lycopersicoides*, indicated that synopsis is almost completely preferential in the tetraploid. I.v.L.

N64-22776* Argonne National Lab., Ill.
GROWTH AND DEVELOPMENT OF PLANTS IN COMPENSATED GRAVITATIONAL, MAGNETIC, AND ELECTRICAL FIELDS Interim Report No. 2
Solon A. Gordon et al 1 Jul. 1963 35 p refs
(NASA Order-R-46)
(NASA-CR-51180) OTS: $3.60 ph

Biological response to continuous accelerations in magnitude on the order of a micro-g has been observed. To determine the threshold of such accelerations, a variable-velocity two-dimensional compensator has been developed. A multiple one-dimensional apparatus was also constructed for pilot experiments with tissue cultures. A rigorous mathematical foundation was derived for design of a 3-dimensional compensator for field nullification. Author

N64-22777* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BACTERIA UNDER SIMULATED MARTIAN CONDITIONS
R. S. Young, P. H. Deal, J. Bell, and J. L. Allen [1963] 12 p refs Presented at the COSPAR Symp. Warsaw, 3–11 Jun. 1963 Submitted for Publication
(NASA-TM-X-50873) OTS: $1.60

A new technique for simulation of known parameters of the Martian environment is discussed along with possible biological implications. The response of bacteria to such simulation is demonstrated in terms of survival and growth, showing that certain bacteria will not only survive, but grow during simulated Martian freeze—thaw cycling if water is present. Ways are demonstrated in which water can be present on Mars although not detectable with current technology. C.L.W.

N64-22780* Aeronutronic, Newport Beach, Calif.
EXPERIMENTAL STUDIES FOR THE DETECTION OF PROTEIN IN TRACE AMOUNTS (J-BANDS) First Quarterly Status Report, 1 Feb. 1962–30 Apr. 1962
R. E. Kay [1962] 4 p
(Contract NASr-84)
(NASA-CR-56520; QLR-62-10) OTS: $1.10 ph

Nine cyanine and carbocyanine dyes were tested for J-band formation with gelatine over the pH range of 1 to 12. Of these, only 3,3' diethyl-9 methyl 4,5,4',5' dibenzothiacarbocyanine bromide (1) gave a J-band. Dyes that had structures similar to 1, except that they were not substituted at the 4,5,4',5' position, did not respond. Carbocyanine dyes substituted at the 4,4' and/or 5,5' position are being synthesized to be tested. Light sensitivity, heat sensitivity, decomposition during storage, and pH studies are discussed for 1. N.E.A.

N64-22781* Stanford U., Palo Alto, Calif. Biophysics Lab.
MOLECULAR EVOLUTION IN PROTOBIOLOGICAL SYSTEMS, INCLUDING A SEARCH FOR CATALYSTS AND CATALYTIC ACTIVITY IN THE INTERMEDIATE SYSTEMS WHICH FORM DURING THE SYNTHESES OF LOW MOLECULAR WEIGHT ORGANIC COMPOUNDS Semiannual Status Report No. 3, Dec. 1, 1962–May 31, 1963
M. S. Blois, Jr. and H. H. Pattee Jul. 1963 3 p refs
(Grant NsG-218-62)
(BL-86) OTS: $1.10 ph

The ultraviolet photochemistry of amino acids, purines, and pyrimidines was studied along with the protection against uv photolysis afforded by clay surfaces when small molecules are adsorbed upon them. Experiments concerned with the production of polymeric and/or insoluble products by the irradiation of aromatic amino acids by ultraviolet were also conducted. One result of the experiments was the confirmation of the predicted stabilizing effect of a clay (montmorillonite) surface upon which guanine was adsorbed. Under given irradiation conditions, guanine in aqueous solution was photolyzed to > 99% in an exposure of 30 hours. Under similar conditions, the guanine adsorbed on clay was, to a considerable extent, still unaffected after 183 hours. P.V.E.

N64-22783* Rochester U., N.Y.
DEVELOPMENT OF A LIFE DETECTOR AND ANALYTICAL INSTRUMENTS FOR PLANETARY SOILS Status Report, Sep. 1961–Feb. 1963
W. Vishniac [1963] 5 p
(Grant NsG-209-62)
(NASA-CR-56523) OTS: $1.10 ph

A flight model of an extraterrestrial life detector, called the Wolf Trap, is being constructed; and a laboratory model of a device to analyze major soluble constituents of planetary soils is described. The soil analyzer operates on paper chromatography principles, and the information is transmitted as the R_f of the individual spots. A pumping apparatus slowly transfers soil extracts to a continuous strip of chromatography paper. The apparatus selects on command from a bank of extracting liquids, spray reagents, and developers. The developed paper strip then moves past a phototube scanner, and the location of the spots is transmitted and recorded. M.P.G.

N64-22784* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE SPACE ENVIRONMENT IN BIOLOGICAL PERSPECTIVE
Webb Haymaker [1962] 13 p refs Presented at the AFIP Centennial, Washington, Nov. 7–9, 1962
(NASA-TM-X-51744) OTS: $1.60 ph

A review of space environment in biological perspective includes: (1) the possibility of extraterrestrial life on the Moon, Mars, and Venus; and (2) the two aspects of environmental biology, i.e., the role of environmental inputs in the establishment and maintenance of life organization and life processes such as biological rhythmicity; and the delineation of those aspects in the space environment which are biologically hostile. I.v.L.

N64-22785* National Research Corp., Cambridge, Mass.
EFFECTS OF SIMULATED SPACE ENVIRONMENTS ON THE VIABILITY OF MICROORGANISMS Quarterly Status Report, Apr. 16, 1962–Jul. 15, 1962
Norman S. Davis, Gerald Silverman, Samuel A. Goldblith (MIT), and Wayne H. Keller 19 Sep. 1962 25 p refs
(Contract NASr-41; NRC Proj. 42-1-0113A)
(NASA-CR-56524) OTS: $2.60 ph

Microorganisms have been exposed to controlled environment to investigate their survival capabilities in space and provide data relevant to the transportation of organisms from one planet to another. The spores from pure cultures of *B. stearothermophilus*, *B. subtilis var. niger*, *B. megaterium*, *C. sporogenes*, and *A. niger* were exposed to high temperature (90° C) and gamma irradiation (200,000 rads) at both atmospheric and 1×10^{-8} torr pressures. At 90° C there were no survivors after exposure to vacuum, and only *B. subtilis var. niger* survived seven days' exposure to this temperature at atmospheric pressure. From the irradiation experiments, it was shown that *B. megaterium* is the most resistant to gamma rays. All of the spores were more resistant to irradiation under vacuum conditions than under atmospheric conditions. R.C.M.

N64-22786* National Research Corp., Cambridge, Mass.
EFFECTS OF SIMULATED SPACE ENVIRONMENTS ON THE VISIBILITY OF MICROORGANISMS Quarterly Status Report, Oct. 16, 1962–Jan. 15, 1963
Norman S. Davis, Gerald Silverman, Samuel A. Goldblith (MIT), and Frank C. Benner 12 Mar. 1963 9 p
(Contract NASr-41) OTS: $1.10 ph

The study of microorganisms under vacuum simulated space environment is reported. Organisms have been isolated from samples of Mohave Desert soils. Only eight of the 50 cultures obtained were able to survive vacuum at 120° C. Seven of the cultures were colorless, punctiform, and sporeforming, while the other culture was amber and butyrous. Spores of microorganisms including *A. niger* and *B. subtilis* var. *niger* are being subjected to UV irradiation while under vacuum. In preliminary tests these spores showed 0.1% and 0.5% survival, respectively, after being subjected to a UV dose of 200,000 ergs. R.C.M.

N64-22787* Florida State U., Tallahassee Inst. for Space Biosciences
EMERGENT ORGANIC CHEMISTRY UNDER VARIOUS PLANETARY CONDITIONS AND EXTRATERRESTRIAL MATRICES AND ENVIRONMENTS First Annual Report [1 Oct. 1961–30 Sep. 1962]
Sidney W. Fox, Seymour L. Hess, and Charles B. Metz 1 Nov. 1962 52 p refs
(Grant NsG-173-62)
(NASA-CR-56526) OTS: $5.60 ph

The organic chemistry that can emerge under a variety of planetary conditions is being investigated. Studies that are summarized and relate to this emergence are: abiogenesis, planetary atmospheres, the genetic mechanisms of plant tissue cultures and the evolutionary divergence of chromosomes, and fertilization physiology. A.R.B.

N64-22788* Florida State U., Tallahassee Inst. for Space Biosciences
STUDY OF ORGANISMS UNDER TERRESTRIAL AND EXTRATERRESTRIAL CONDITIONS First Semi-Annual Report
Sidney W. Fox, S. L. Hess, and C. B. Metz 15 Mar. 1962 12 p refs
(Grant NsG-173-62)
(NASA-CR-56527) OTS: $1.60 ph

An investigation is made of processes involved in the origin, evolution, and development of organisms under terrestrial and extraterrestrial conditions. The study includes work on the following: proteinoids, microspheres, the vertical structure of the atmosphere of Venus, immunochemical studies, research on antiradiation extracts, and observations of Jupiter. J.R.C.

N64-22789* Yale U., New Haven, Conn.
DEVELOPMENT OF A LIFE DETECTOR FOR PLANETARY SOILS Final Report, Jun. 1960–Aug. 1961
Wolf Vishniac [1961] 7 p
(Grant NsG-19-59)
(NASA-CR-56528) OTS: $1.10 ph

This report deals with the final laboratory version of a device which is capable of detecting living organisms when placed on soil or on the laboratory floor. This device operates on the principle of introducing dust samples into one or more selected media in which the growth of the microorganisms is detected by optical and chemical changes in the medium, i.e., the change in light transmission and the change in pH, respectively. I.v.L.

N64-22790* California U., Berkeley Space Sciences Lab.
BIOCHEMICAL ACTIVITIES OF TERRESTRIAL MICROORGANISMS IN SIMULATED PLANETARY ENVIRONMENTS Interim Report, 1 Aug. 1962–31 Jan. 1963
Samuel Silver 5 Apr. 1963 6 p refs Ser. 4, Issue 24
(Grant NsG-126-61)
(NASA-CR-56529) OTS: $1.10 ph

Experiments concerned with extremes of temperature and other environmental factors, which might serve as possible restraints to the development of microorganisms on nearby planets, have been conducted. The results show that a variety of microbial types in their native soil environments, as in artificial media, can survive temperatures from ca. 200° to 300° K (Mars). Spore-forming bacteria capable of withstanding 10^{-8} mm Hg were recovered from soil samples maintained under anaerobic conditions at 373° K (Moon). A comparative study of photosynthetic bacteria and algae is being conducted at present. J.A.J.

N64-22791* Communication Research Inst., Miami, Fla.
A STUDY OF THE FEASIBILITY AND METHODOLOGY FOR ESTABLISHING COMMUNICATION BETWEEN MAN AND OTHER SPECIES Interim Report [1 Jul. 1962–1 Jan. 1963]
John C. Lilly 9 Jan. 1963 9 p
(Grant NsG-278-62)
(NASA-CR-56530) OTS: $1.10 ph

Current research is proceeding along two major lines, i.e., an analysis of the dolphins' own emissions to one another and their development of the English language. The sonic spectrum available to these animals is being studied. A study of the man-dolphin relationship is continuing and has already shown that a wild dolphin within a few hours of capture will accept boys riding on its back. R.C.M.

N64-22792* Stanford U., Calif. Biophysics Lab.
MOLECULAR EVOLUTION IN PROTOBIOLOGICAL SYSTEMS, INCLUDING A SEARCH FOR CATALYSTS AND CATALYTIC ACTIVITY IN THE INTERMEDIATE SYSTEMS WHICH FORM DURING THE SYNTHESES OF LOW MOLECULAR WEIGHT ORGANIC COMPOUNDS Semiannual Status Report No. 1, Dec. 1961–May 1962
M. S. Blois, Jr. and H. H. Pattee Jul. 1962 5 p
(Grant NsG-218-62)
(NASA-CR-56531; BL-71) OTS: $1.10 ph

Molecular evolution in protobiological systems is under investigation. Research includes a search for catalysts and catalytic activity in the intermediate systems, which form during the syntheses of low-molecular-weight organic-compounds. I.v.L.

N64-22793* Resources Research, Inc., Washington, D.C.
RADIOISOTOPIC BIOCHEMICAL PROBE FOR EXTRATERRESTRIAL LIFE Quarterly Progress Report No. 7
Gilbert V. Levin, Norman H. Horowitz, Allen H. Heim, and Mary-Frances Thompson 10 Dec. 1962 31 p refs
(Contract NASr-0)
(NASA-CR-56532) OTS: $3.60 ph

Modifications of the medium have been made that decrease the quantities of complex constituents. This has been done by using yeast extract and peptone at concentrations of one-half those initially used and by completely removing the amino acid hydrolysate from the medium. These changes do not affect the present test cultures adversely and may be better for some of the facultative autotrophic organisms. Studies of the effects of several antimetabolites have continued. Bard–Parker germicide can be heated at 135° C for 2[illegible]

hours and still inhibit the range of test organisms without resulting in excessive sterile control levels. A working model of the instrument has been developed that is capable of functioning without attitude control. Mechanical aspects of the field tests with the new instrument have been satisfactory. The solid-state radiation detector used previously has been replaced with an anticoincident geiger detection system. Author

N64-22851 California U., Berkeley Lawrence Radiation Lab. Donner Lab. and Donner Pavilion

BIOLOGY AND MEDICINE Semiannual Report, Fall 1963

John H. Lawrence and Tove Neville, ed. [1963] 145 p refs (Contract W-7405-ENG-48)
(UCRL-11184) OTS: $2.75

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15. STUDIES ON THE MAMMALIAN RADIATION SYNDROME WITH HIGH-ENERGY PARTICULATE RADIATION. II. SOME FACTORS AFFECTING RBE OF 730-MeV PROTONS C. A. Sondhaus, J. K. Ashikawa, C. A. Tobias, V. Paschkes and D. Love p 128–135 refs (See N64-22866 16-16)

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17. SOME METRIC PROPERTIES OF THE SYSTEMS OF COMPARTMENTS A. Rescigno and G. Segre p 141–149 refs (See N64-22868 16-16)

18. ON THE METABOLISM OF RADIOBROMIDE IN THE THYROID GLAND OF RATS G. L. Roche and R. R. Brown p 150–156 refs (See N64-22869 16-16)

N64-22852 California U., Berkeley Lawrence Radiation Lab.

ALLELIC MAPPING IN YEAST USING X-RAY-INDUCED MITOTIC REVERSION

Thomas R. Manney and Robert K. Mortimer *In its* Biol. and Med. [1963] p 1–5 refs (See N64-22851 16–16) OTS: $2.75

A new method for determining the sequence of mutational sites is based on the linear dose-effect relation for X-ray induction of allelic recombination in Saccharomyces cerevisiae. Mutations at two loci were mapped by this method. The use of X-rays simplifies allelic mapping and greatly increases its sensitivity. Author

N64-22853 California U., Berkeley Lawrence Radiation Lab.

EFFECT OF ERYTHROPOIETIC STIMULATION ON MARROW DISTRIBUTION IN MAN, RABBIT AND RAT AS SHOWN WITH Fe^{59} AND Fe^{52}

Donald Van Dyke, Hal O. Anger, and Myron Pollycove *In its* Biol. and Med. [1963] p 6–19 refs (See N64-22851 16–16) (Sponsored in part by AEC) OTS: $2.75

Distribution of marrow within the skeleton has been determined in man, rabbits, and rats by in vivo labeling of the marrow compartment with radioiron and, depending on the resolution required, either by assaying each bone separately for radioactivity or by obtaining a gamma-ray image of the distribution of the marrow by whole-body scanner or with the positron scintillation camera. The positron scintillation camera provides an excellent method for qualitative evaluation of the marrow distribution. The camera has sufficient resolving power to give a good picture of the distribution of marrow with Fe^{52} in a skeleton as small as that of the rat. The distribution apparent from the positron pictures has been confirmed by complete skeletal analysis of individual bones. Author

N64-22854 California U., Berkeley Lawrence Radiation Lab.

SOME PROPERTIES OF SERUM FROM RABBITS IMMUNIZED WITH HUMAN URINARY ERYTHROPOIETIN

John C. Schooley and Joseph F. Garcia *In its* Biol. and Med. [1963] p 20–36 refs (See N64-22851 16-16) OTS: $2.75

Sera obtained from rabbits after immunization with human urinary ESF can neutralize the biological activity of human urinary, sheep, rat, and rabbit plasma ESF. Such sera can depress erythropoiesis in normal mice. The neutralizing ability of such sera is found in the γ globulins. The finding that absorptions of the immune sera with a wide variety of proteins did not alter the neutralizing ability suggests that considerable immunological specificity is involved in the neutralization reaction. The injection or addition of antisera against proteins or protein hormones known to be of importance in normal erythropoiesis has little or no effect on the ability of exogenous ESF

to stimulate erythropoiesis in polycythemic mice. These properties of the immune sera are consistent with the concept that the neutralization of the biological activity of ESF by anti-ESF is the result of an immunological reaction. The availability of such immune sera offers a potent tool for investigating many of the current problems on the role of ESF in the regulation of erythropoiesis. Author

N64-22855 California U., Berkeley Lawrence Radiation Lab.

ELECTROPHORETIC BEHAVIOR OF OsO_4-FIXED AND $KMnO_4$-FIXED RAT ERYTHROCYTES

Robert M. Glaeser (Ph.D. Thesis) and Howard C. Mel *In its* Biol. and Med. [1963] p 37–50 refs (See N64-22851 16–16) (Sponsored by AEC)
(UCRL-10898) OTS: $2.75

Mobility-pH curves at ionic strength 0.145 and mobility-ionic strength curves at pH 7.3 are reported for OsO_4-fixed, $KMnO_4$-fixed and unfixed rat RBC. OsO_4 fixation imparts great stability to the RBC, permitting extension of mobility measurements down to pH 0.9 and up to pH 12.3. The pH-mobility curves for OsO_2-fixed and for unfixed cells are identical over the entire range for which data can be obtained for unfixed RBC. Both types are isoelectric at pH 1.6. The OsO_4-fixed cells reversibly acquire a positive charge below pH 1.6, and acquire an increased (negative) mobility above pH 11.0. These two new features are believed to represent intrinsic properties of the normal unfixed RBC. The entire extended mobility-pH curve appears consistent with the idea that outer-surface sialic acid (N-acylated neuraminic acid) is solely responsible for their charge (electrophoretic) characteristics. $KMnO_4$-fixed RBC show considerably altered pH-mobility (hence surface) characteristics, compared with OsO_4-fixed and unfixed RBC. This is ascribed to differences in chemical reactivity of OsO_4 and $KMnO_4$. Mobilities of both kinds of fixed cells are virtually identical at all ionic strengths at pH 7.3 but are lower than those of the unfixed cells at lower ionic strengths. Author

N64-22856 California U., Berkeley Lawrence Radiation Lab.

RAPID CONTINUOUS ELECTROPHORETIC CONCENTRATION OF DILUTE PROTEIN SOLUTIONS

Howard C. Mel, Hans F. Loren, and Joan Manning (California U., San Francisco) *In its* Biol. and Med. [1963] p 51–54 refs (See N64-22851 16-16)
(Sponsored by AEC) OTS: $2.75

Stable-flow free-boundary (STAFLO) electrophoresis was used for concentrating dilute separated fractions of serum proteins while the macromolecules remained in unheated aqueous solution and did not contact foreign surfaces or organic solvents. A concentration factor of 10.1 was achieved, with recovery of 96.3% of the input solute in the first two fractions. D.E.W.

N64-22857 California U., Berkeley Lawrence Radiation Lab.

CONTINUOUS FREE-FLOW FRACTIONATION OF CELLULAR CONSTITUENTS IN RAT BONE MARROW

Howard C. Mel, Linda T. Mitchell, and Bo Thorell (Karolinska Inst.) *In its* Biol. and Med. [1963] p 55–68 refs Based in part on a talk presented at the Conf. on Bone Marrow Transplantation and Irradiation Protect., Atlantic City, 16 Apr. 1963 (See N64-22851 16–16)
(Sponsored by AEC) OTS: $2.75

A single-cell suspension of normal rat bone marrow is prepared mechanically. This suspension is continuously fractionated in free solution, under sedimentation rate conditions, using 1 g only. With a sample flow of 2.2×10^6 cells/min and a 32-min steady-state residence time in the stable-flow free-boundary (STAFLO) flow-cell, the cells exit almost entirely into 7 of the 12 collection bottles. Maximum numbers of different cell types are observed, with good repeatability, in approximately descending order from top to bottom as follows: erythrocytes, erythroblasts, "immatures," myelocytes, and mature granulocytes. Major changes are effected relative to the starting marrow composition, and very large relative enrichments are achieved for certain cell types. Author

N64-22858 California U., Berkeley Lawrence Radiation Lab.

SCINTILLATION CAMERA WITH 11-INCH CRYSTAL

Hal O. Anger *In its* Biol. and Med. [1963] p 69–85 refs (See N64-22851 16-16) OTS: $2.75

The scintillation camera is a sensitive electronic instrument that produces pictures of the distribution of gamma ray and positron emitting isotopes. It consists of the following: (1) a collimator for producing a gamma-ray image of the subject; (2) a large, flat, sodium iodide crystal that transforms the gamma-rays into a pattern of scintillations; (3) a hexagonal array of phototubes spaced a short distance away from the crystal; (4) a computing circuit that determines the position and the brightness of scintillations in the crystal; (5) a pulse-height selector; (6) a cathode-ray oscilloscope that receives signals from the computing circuit and reproduces the desired scintillations as bright points of light in their proper locations on the cathode-ray tube; and (7) an optical camera for recording these flashes of light as dots on photographic film. It has been used to localize tumors, to show the shape, size, and location of organs, and to illustrate and measure functions of organs in human subjects. It sensitivity is 3 to 20 times that of mechanical scanners with focused collimators, and permits a reduction in isotope dosage or in the examination time. D.E.W.

N64-22860 California U., Berkeley Lawrence Radiation Lab.

INTERRELATIONSHIPS BETWEEN SERUM LIPIDS, SERUM LIPOPROTEINS AND LIPOPROTEIN COMPOSITION

Frank T. Lindgren, Norman K. Freeman, and Robert D. Wills *In its* Biol. and Med. [1963] p 91–97 refs (See N64-22851 16–16) OTS: $2.75

The interrelationships between the low-density lipoproteins and the total serum level of the commonly measured lipids (total lipid, total cholesterol, phospholipid, and glycerides) were evaluated for 32 normal males (ages 35 to 49 years). A most striking relationship ($r = 0.99$) was observed between the level of the S_f 20×10^5 (very low-density lipoproteins) and total serum glyceride. Chemical-composition studies indicated that the level of the S_f 20×10^5 lipoproteins (or total serum glyceride) was positively correlated with the percentage composition of glyceride in two lipoprotein classes—the S_f 0×20 and the HDL_{2+3} lipoprotein class. The highest degree of correlation ($r = 0.90$) was observed for the high-density lipoproteins, suggesting their potential importance in the transport and metabolism of glycerides. Author

N64-22861 California U., Berkeley Lawrence Radiation Lab.

AN IMPROVED METHOD FOR THE COMPUTER ANALYSIS OF GAS-LIQUID CHROMATOGRAMS

Alicia M. Ewing, Pamela P. Walker, Robert D. Wills, and Frank T. Lindgren *In its* Biol. and Med. [1963] p 98–103 refs (See N64-22851 16–16)
(Grants HE G-01882-09; HE G-02029-08) OTS: $2.75

An improved method for the computer analysis of gas-liquid chromatograms is presented. The analytical results are presented in terms of the relative mass, relative retention time, and percentage composition of each component of the chromatogram. In addition, the procedure provides for the optional calculation of absolute mass, correction of calibration factors, peak-height correction for unresolved components, and subtraction of contaminating components from each chromatogram. Author

N64-22862 California U., Berkeley Lawrence Radiation Lab.
INFRARED MICROMETHOD FOR SERUM TRIGLYCERIDES AND CHOLESTERYL ESTERS
Norman K. Freeman *In its* Biol. and Med. [1963] p 104–109 refs (See N64-22851 16–16) OTS: $2.75

Further experience with an infrared spectrophotometric method for the determination of serum triglycerides and cholesteryl esters is reported. Two new aspects considered are the use of a single-step combined extraction and adsorption procedure, and the feasibility of analyzing 0.05-ml serum samples. The simplified extraction, in comparison with the two-step procedure, is substantially equivalent in accuracy and slightly poorer in precision. Author

N64-22863 California U., Berkeley Lawrence Radiation Lab.
OSMIUM TETROXIDE-TRIGLYCERIDE INTERACTION AS A FUNCTION OF DEGREE OF UNSATURATION. AN X-RAY FLUORESCENCE STUDY
Thomas L. Hayes and James N. Hawkins *In its* Biol. and Med. [1963] p 110–112 refs (See N64-22851 16–16) OTS: $2.75

A quantitative determination of the amount of osmium found in triglycerides, following a 1/2-hr reaction with 1% buffered osmium tetroxide, showed that the amount of osmium is approximately proportional to the number of double bonds found in the molecule. Author

N64-22864 California U., Berkeley Lawrence Radiation Lab.
LIPID TRANSFER BETWEEN HUMAN HIGH-DENSITY AND S_f 20-10^5 LIPOPROTEINS
Alex V. Nichols and Lester Smith *In its* Biol. and Med. [1963] p 113–120 refs (See N64-22851 16–16)
(Grant HE G-02029-09) OTS: $2.75

Transfer of S_f 20 × 10^5 glyceride to human serum high-density lipoproteins occurs during incubation of serum with S_f 20×10^5 lipoproteins. Uptake of glyceride by HDL is associated with reciprocal reductions in HDL cholesterol ester content. An artificial lipid emulsion, Ediol, also transfers glyceride to HDL and displaces HDL cholesterol esters. The amount of glyceride transferred per amount Ediol glyceride added to incubation system is significantly less than observed for the S_f 20 × 10^5 glyceride. The implications of such glyceride transfer and cholesterol ester dislocation to lipoprotein chemistry are discussed. Author

N64-22865 California U., Berkeley Lawrence Radiation Lab.
USE OF THE BRAGG PEAK FOR BRAIN-TUMOR THERAPY
Alexander Gottschalk, John T. Lyman, and Larry W. Mc Donald *In its* Biol. and Med. [1963] p 121–127 refs (See N64-22851 16–16) OTS: $2.75

Three patients with brain tumors were treated by the Bragg peak of the 910-Mev alpha-particle beam from the 184-in. synchrocyclotron. All had had subtotal tumor resection prior to therapy. The case histories are presented; the technique of dosimetry and the method of irradiation are discussed. Author

N64-22866* California U., Berkeley Lawrence Radiation Lab.
WITH HIGH-ENERGY PARTICULATE RADIATION. II. SOME FACTORS AFFECTING RBE OF 730-MeV PROTONS
Charles A. Sondhaus, James K. Ashikawa, Cornelius A. Tobias, Vally Paschkes, and David Love *In its* Biol. and Med. [1963] p 128–135 refs (See N64-22851 16-16)
(Sponsored by NASA) OTS: $2.75

A series of seven experiments was performed with 730-Mev protons, and with 100-kvp and 250-kvp X-radiation, and the relative lethality and time course of radiation injury were studied in more than 2,000 Swiss Webster white male mice. Results show that RBE values can differ between radiations of similar linear energy transfer (LET), even under uniform exposure geometry, when differences in dose-rate dependence and injury mode are present. Therefore, specification of the effect to which a proton exposure RBE applies is necessary, as is the introduction of a dose-rate factor in calculating RBE for exposures to low LET radiations. D.E.W.

N64-22868 California U., Berkeley Lawrence Radiation Lab.
SOME METRIC PROPERTIES OF THE SYSTEMS OF COMPARTMENTS
Aldo Rescigno and Giorgio Segre (Harvard U.) *In its* Biol. and Med. [1963] p 141–149 refs (See N64-22851 16–16)
(Sponsored in part by NASA and AEC) OTS: $2.75

Rules for the enumeration of the strong components of a graph and for the calculation of its variable adjacency matrix are presented. A new method is given, to calculate the transfer function of a graph, by analyzing the strong components of the graph, the elementary paths between two nodes, and linear subgraphs. Author

N64-22869 California U., Berkeley Lawrence Radiation Lab.
ON THE METABOLISM OF RADIOBROMIDE IN THE THYROID GLAND OF RATS
Gilles La Roche and Richard Brown *In its* Biol. and Med. [1963] p 150–156 refs (See N64-22851 16–16)
(Sponsored in part by NSF) OTS: $2.75

No evidence was found to support the hypothesis of bromine organification by the thyroid gland or serum of rats maintained on low-iodine diet up to 24 days. Radiobromide dosage did not significantly influence the concentrating ability of the thyroid gland or the amount of radiobromide in the sera as observed between groups B and C. The level of radiobromide present in the thyroid gland or serum, 24 hr after administration, may be dependent on sex or on the chronic effects of low iodine intakes. Author

N64-22879 Joint Publications Research Service, Washington, D.C.
USING FREQUENCY CHARACTERISTICS TO STUDY THE BODY TEMPERATURE REGULATORY SYSTEM OF WHITE RATS BEFORE AND AFTER COLD ADAPTATION

Cheng Lanying, Wang Yun-chiu, Chao Chin-mei, Chuan Tzu-sen, and Chiang Kuan-ch'ang *In its* Transl. on Communist China's Sci. and Technol. no. 87 26 May 1964 p 47–49 refs (See N64-22876 16-01) OTS: $1.25

Frequency characteristics are transfer functions used in engineering technology to measure linear regulatory systems and to determine the properties of a system. This article describes an experiment using the frequency characteristics method to quantitatively and dynamically describe the body-temperature system of white rats before and after adaptation. G.D.B.

N64-22940* National Aeronautics and Space Administration, Washington, D.C.
SPACE SUITS [SKAFANDR DLYA KOSMICHESKOGO POLETA]
F. Romanov May 1964 18 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 1 Jan. 1964 p 52–55
(NASA-TT-F-8852)

The space suit not only protects the astronaut from the atmosphere in the capsule in case any impurities should develop, but also protects him from overcooling after a parachute landing under low-temperature conditions, prevents the possibility of shock should the parachute drift into mountainous or wooded areas, and lends buoyancy in the case of a water landing. The space suit control system seals the suit, supplies it with oxygen, removes waste gases, and maintains the required gas medium temperature in the space suit. J.L.D.

N64-23019* Wilmot Castle Co., Rochester, N.Y. Research Labs.
STUDIES FOR STERILIZATION OF SPACE PROBE COMPONENTS Progress Report no. 2, 1 Dec. 1963–1 Mar. 1964
Martin G. Koesterer [1964] 27 p refs
(Contract NASw-879)
(NASA-CR-56474) OTS: $2.60 ph

The current research activities that were continued or initiated include the following: (1) studies on the dry-heat resistance of microorganisms entrapped from air, added to sterile kaolin, in various gaseous atmospheres, and in activated carbon; and (2) studies that were initiated on the sterilization of components. N.E.A.

N64-23042* National Aeronautics and Space Administration, Washington, D.C.
EFFECT OF SPACE FACTORS DURING THE FLIGHT OF THE SATELLITES "VOSTOK 3" AND "VOSTOK 4" ON THE MICROSPORES OF *TRADESCANTIA PALUDOSA* [VLIYANIYE FAKTOROV KOSMICHESKOGO POLETA NA KORABLYAKH-SPUTNIKAKH "VOSTOK-3" I "VOSTOK-4" NA MIKROSPORY *TRADESCANTIA PALUDOSA*]
N. L. Delone, P. R. Popovich, V. V. Antipov, and V. G. Vysotskiy Feb. 1964 21 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, Sep.–Oct. 1963 p 312–325
(NASA-TT-F-8825)

In experiments with microspores of Tradescantia, part of the material was fixed by P. R. Popovich, 56 hours after launching, and thus the effect of vibration and acceleration, which acted on the biological specimen during the descent of the ship, was eliminated. Analysis of the material obtained revealed a new type of rearrangement: spherical fragments that could be recorded not only in the metaphase, anaphase, and telophase, but also in the prophase and interphase. In addition, various impairments of mitosis were noted. Author

N64-23043* National Aeronautics and Space Administration, Washington, D.C.
EFFECT OF SPACE-FLIGHT FACTORS ON THE INCIDENCE OF SEX-LINKED RECESSIVE LETHAL MUTATIONS IN *DROSOPHILA MELANOGASTER* [VLIYANIYE FAKTOROV KOSMICHESKOGO POLETA NA CHASTOTU VOZNIKNOVENIYA STSEPLENNYKH S POLOM RETSESSIVNYKH LETHAL'NYKH MUTATSIY U *DROSOPHILA MELANOGASTER*]
Ya. L. Glembotskiy, Yu. A. Lapkin, G. P. Parfenov, and Ye. M. Kamshilova Feb. 1964 14 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, Sep.–Oct. 1963 p 326–334
(NASA-TT-F-8826)

A description is given of the experiments conducted with the spaceships Vostok III and Vostok IV dealing with the effect of space-flight factors on mutations in *Drosophila melanogaster*. These data are compared with the results of similar experiments conducted during five previous space flights, which involved not only *Drosophila* but other specimens as well (i.e., mice and seeds of various plants). Although these specimens reacted very differently to the conditions of different flights, a certain parallelism was observed in the heredity reaction of all of these specimens to the condition of each individual flight. It is hypothesized that such a situation results from the variation of the mutagenic effect of certain space-flight factors, i.e., weightlessness, rocket vibrations, acceleration, or cosmic radiation. Author

N64-23046* National Aeronautics and Space Administration, Washington, D.C.
CHANGES IN THE HARD DENTAL TISSUES AFTER REPEATED SMALL DOSES OF IONIZING RADIATION [IZMENENIYA TVERDYKH TKANEY ZUBA POSLE MNOGOKRATNOGO VOZDEYSTVIYA NA ORGANIZM MALYKA DOZ IONIZIRUYUSHCHEY RADIATSII
A. A. Prokhonchukov Mar. 1964 7 p refs Transl. into ENGLISH from Med. Radiol., (USSR), v. 2, no. 4, 1957 p 74–78
(NASA-TT-F-8851)

The condition of the hard dental tissues of rats after 28 to 36 irradiations by small doses (25 r) of X-rays was studied in experiments conducted with radioactive isotopes of phosphorus and calcium (P^{32} and Ca^{45}). It was revealed that changes in the phosphorocalcium metabolism depend on the total ionizing radiation dose. The phosphorocalcium metabolism is activated in the hard dental tissues of rats after irradiation by a total dose of 700 r. If the total dose is increased to 900 r, activation of the phosphorocalcium metabolism becomes pronounced. Disturbances of the mineral metabolism in the hard dental tissues reflect the general metabolic changes and the changes in the mineral metabolism of the whole body during radiation sickness. Author

N64-23051* National Aeronautics and Space Administration, Washington, D.C.
CAUSES FOR LETHALITY OF EMBRYONIC CELLS IN DROSOPHILA AFTER THE FLIGHTS OF THE VOSTOK 3 AND VOSTOK 4 SPACECRAFT [PRICHINY LETAL'NOSTI ZARODYSHEVYKH KLETOK U DROZOFILY POSLE POLETOV KOSMICHESKIKH KORABLEY-SPUTNIKOV "VOSTOK-3" I "VOSTOK-4"]
G. P. Parfenov Jun. 1964 9 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 2, no. 2, 1964 p 335–340
(NASA-TT-F-8898)

The results of some experiments on *Drosophila* carried

out during the flights of the Vostok 3 and Vostok 4 are presented. In addition to new information on dominant lethal mutations in males, data are presented on the frequency of this type of mutation in females; it is shown that the frequency of dominant lethals does not increase in male gametes. The slight increase in the number of dead eggs in the experimental groups is ascribed to a reduction in the vigor of male sexual behavior after the space flights. The increase in dominant lethals observed in male gametes was not caused by radiation. Author

N64-23063 Joint Publications Research Service, Washington, D.C.

***VESTNIK* OF USSR ACADEMY OF MEDICAL SCIENCES, VOL XIX, NO. 4, 1964**

22 Jun. 1964 73 p refs Transl. into ENGLISH of Vestnik Akad. Med. Nauk SSSR (Moscow), v. 19, no. 4, 1964 p 3–104 (JPRS-25208; OTS-64-31540) OTS: $3.00

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N64-23098 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A NORMAL DAY IN THE LIFE OF OUR COSMONAUTS

A. Aleksandrov 27 Feb. 1964 6 p Transl. into ENGLISH from Krasnaya Zvezda (Moscow), no. 288 (12198), 8 Dec. 1963 p 4

(FTD-TT-64-66/1; AD-433541)

This is a nontechnical article describing the activities of Soviet cosmonauts in the course of a day of physical and mental training. G.D.B.

N64-23109 Aerospace Medical Div. Arctic Aeromedical Lab., Fort Wainwright, Alaska

EFFECT OF COLD EXPOSURE ON THE ACTION OF MORPHINE IN RATS AND MICE

E. L. Way and H. W. Elliott Nov. 1963 28 p refs

(Contract AF 41(657)-413)

(AAL-TDR-62-50; AD-434079)

Data are presented showing that cold adaptation diminishes the depressant effects of morphine on respiratory minute volume, oxygen consumption, and analgesia on the one hand, but enhances the toxicity of morphine on the other. Attempts to account for the difference in sensitivity between cold-adapted and nonadapted animals by measuring the conjugation, excretion, and distribution of morphine in vivo, and by determining its effect on the respiration of KCl-stimulated brain slices in vitro were unsuccessful. Author

N64-23117* National Aeronautics and Space Administration, Washington, D.C.

A NEW METHOD IN TREATMENT OF PAROXYSMAL, AURICULAR FIBRILLATION [A PAROXYSMALIS PITVARI FIBRILLATIO KEZELESENEK UJABB MODSZERE]

Erno Somlo Dec. 1963 6 p refs Transl. into ENGLISH from Orv. Hetilap (Budapest), v. 102, 23 Apr. 1961 p 783–785 (NASA-TT-F-8555)

In three patients having 56 attacks, the oral procaine amide–Quinaglute treatment successfully converted periodic attacks of auricular fibrillation into sinus rhythm. In the prevention of attacks, Quinaglute, which is absorbed faster than quinidine sulphate and is effective longer, is an improvement. It seems that the combined oral treatment will be useful also in paroxysmal supraventricular tachycardia. Author

N64-23133* National Aeronautics and Space Administration, Washington, D.C.

LATITUDINAL AND SEASONAL DISTRIBUTION OF THE DAILY MAXIMA AND MINIMA OF F_0F2 VALUES [O SHIROTNOM I SEZONNOM RESPREDELENI MAKSIMAL'NYKH: MINIMAL'NYKH SUTOCHNYKH ZNACHENIY f_0F2]

N. M. Boyenkova Jun. 1964 9 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 4, no. 1, 1964 p 174–178

(NASA-TT-F-9018)

The behavior of f_0F2_{max} and f_0F2_{min} as a function of the geographic latitude of the observation point is considered for three seasons: winter (January), equinox (March), and summer (July). There exists some type of inverse relationship between the position of the sun and f_0F2_{max} and f_0F2_{min} The values of f_0F2_{max} are a function of the angle of solar descent (i.e., a function of the solar altitude at midnight) and not a function of the solar altitude at noon as it should be. The values of f_0F2_{min} that are observed prior to the sunrise are a function of the solar altitude at noon. Thus, for f_0F2_{max} and f_0F2_{min} there exists approximately a half-day lag (more precisely, a 10- to 18-hr lag) with respect to the position of the sun. As a result, f_0F2_{max} is observed approximately at noon, but is a function of the angle of the solar descent taken at midnight. However, f_0F2_{min} is observed before sunrise (3:00 a.m. to 6:00 a.m.) but is a function of the solar altitude at noon. P.V.E.

N64-23204* National Aeronautics and Space Administration, Washington, D.C.

AN OUTLINE OF THE CLINICAL PHYSIOLOGY OF THE CIRCULATION

V. V. Parin and F. Z. Meyerson Jun. 1964 525 p refs Transl. into ENGLISH of the Book "Ocherki Klinicheskoy Fiziologii Krovoobrashcheniya" Moscow, Medgiz., 1960 (NASA-TT-F-173) OTS: $7.00

This book describes the principal problems of the physiology and pathology of the circulation. The discussion is extensively illustrated with references to the work of Soviet and foreign scientists and to the authors' own experimental material. An attempt is made to give clinical physiology the status of an independent discipline. Author

N64-23255 Joint Publications Research Service, Washington, D.C.

THE EFFECT OF STRESS ON THE RADIOSENSITIVITY OF RATS AND THE EFFECTIVENESS OF THE RADIOPROTECTIVE ACTION OF MERCAMINE

P. D. Gorizontov and I. A. Rudakov 17 Jun. 1964 12 p refs Transl. into ENGLISH from Patol. Fiziol. i Eksperim. Terapiya (Moscow), v. 8, no. 2, Mar.–Apr. 1964 p 17–22
(JPRS-25130; OTS-64-31508) OTS: $0.50

All experiments were performed on rats of both sexes of the Wistar line whose weights were between 160 and 190 grams. The animals were irradiated with a dose of 700 r with the gamma-rays from a Co^{60} source (EGO-2 apparatus) with a dose rate of 263 r per minute. As a prophylactic agent, the rats were given an intraperitoneal injection of mercamine 15 minutes before irradiation in a dose of 100 mg/kg. Electrical stimulation was performed as follows: duration of one pulse, 2 seconds; interval, one minute; current, 2 mo; frequency, 2,000 cps. The change in the nonspecific resistance of the body caused by the action of stimulus alters the sensitivity of the body to the action of ionizing radiation. Mortality does not change. Mercamine as a radioprotective substance is most effective in the stage of resistance though without effect in the initial stage of exhaustion. A.W.

N64-23257 Joint Publications Research Service, Washington, D.C.

PROBLEMS OF LABOR HYGIENE IN PRODUCTION OF METALLIC THALLIUM AND ITS SALTS

T. S. Tikhov 22 Jun. 1964 11 p refs Transl. into ENGLISH from Gigiena i Sanit. (Moscow), v. 29, no. 2, Feb. 1964 p 23–27
(JPRS-25206; OTS-64-31539) OTS: $0.50

Experiments were conducted to determine effects of thallium and its compounds on workers. It was established that thallium is a polystemic poison possessing polytropic action. It is present in the form of solutions, in coarsely dispersed dust, in aerosols, and in dust of slats and alloys, and enters the human organism through skin contamination and/or respiratory organs. Preliminary and periodic medical inspections are necessary to prevent the development of occupational disease through metallic thallium and its salts. A.W.

N64-23275 Philips Gloeilampenfabrieken, N.V., Eindhoven (Netherlands)

GRIDS TO REDUCE SCATTERED X-RAYS IN MEDICAL RADIOGRAPHY

W. Hondius Boldingh (Thesis—Eindhoven Technol. U.) 1964 93 p refs *its* Res. Rept. Suppl. no. 1

The relation between the constructional properties of X-ray grids and their contrast-improving capacity is discussed. Measurements of a number of grids of different construction, under various exposure conditions, by means of an electronic measuring equipment and a water phantom are described and discussed. The importance of the lead content is stressed, and two new specification values are introduced: the focus-grid distance limits and the contrast–improvement factor, which enable a rational choice of grids for various fields of application. A proposition is given for standardization of exposure tables, as far as indications for the use of grids is concerned, based on the contrast–improvement factor. The compensation of the increase of exposure times and doses due to the use of grids, by an increase of the voltage across the X-ray tube, is quantitatively analyzed. Author

N64-23278* Brandeis U., Waltham, Mass.

INDUCIBLE PHAGES OF *BACILLUS SUBTILIS*

Edna Seaman, Elaine Tarmy, and Julius Marmur (Albert Einstein Coll. of Med.) Repr. from Biochemistry, v. 3, no. 5, May 1964 p 607–613 refs *Its* Publ. No. 282
(Grant NsG-375)

A group of prophages induced in *Bacillus subtilis* were studied. The evidence presented indicates that these phages are genetically defective. DNA isolated from the phages exhibits many properties that are similar to host DNA, and is capable of transforming *B. subtilis* with respect to host genetic markers. Author

N64-23295 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CHOICE OF SAFETY FACTOR AND COMPUTATION IN DESIGNING ELECTROMAGNETIC MECHANISMS OF A REQUIRED DEPENDABILITY

Ya. A. Rips 18 Mar. 1963 16 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 4, 1961 p 76–81
(FTD-TT-63-37/1+2; AD-402441)

The problem of designing dependable and safe electromagnetic mechanisms was investigated. The mathematical and engineering methods recommended are illustrated by using them in the design of a d.c. electromagnetic relay with a given operational safety and dependability. R.T.K.

N64-23296 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CHEMISTRY OF BLUE-GREEN ALGAE (CYANOPHYCEAE)

G. K. Barashkov 8 Mar. 1963 p 18 refs Transl. into ENGLISH from Botan. Zh., Akad. Nauk SSSR (Leningrad), v. 46, no. 3, 1961 p 447–454
(FTD-TT-63-193/1; AD-400516)

Bluish green algae are usually distributed in fresh water. In recent years many investigations dealing with the photosynthesis and mineral nutrition of these algae, as well as problems related to their physiology, have been made and are discussed. The knowledge of the chemistry of algae is reviewed as a basis for a better understanding of the processes occurring in them and for proper evaluation of their role in nature. R.T.K.

N64-23308 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE BIOCHEMICAL BASES FOR DEVELOPING PRODUCTS OF HIGHER BIOLOGICAL VALUE

A. A. Pokrovskiy 13 Apr. 1964 28 p refs Transl. into ENGLISH from Voprosy Pitaniya (Moscow), v. 23, no. 1, Jan.–Feb. 1964 p 3–16
(FTD-TT-64-148/1+4; AD-438226)

The need for a well-balanced diet to effectively assimilate food elements is stated, with particular emphasis on the amino acids. The following are discussed and tabulated: (1) average minimum daily amino acid requirements for humans; (2) tryptophan and threonine requirements in the essential

amino acids; (3) amounts of amino acids and fats in most important food products; and (4) amino acid content of belips (protein products made by a combination of cod, fresh cottage cheese, and sunflower oil). The use of proteins in medicinal feeding is discussed briefly. E.K.R.

N64-23309 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

EXPERIMENTAL INVESTIGATIONS IN COSMIC PHYSIOLOGY

P. V. Vasil'yev, A. D. Voskresenskiy, and O. G. Gazenko 16 Jul 1963 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 1, 1963 p 15–23
(FTD-TT-63-719/1+2; AD-416781)

Man's ability to endure lateral and transverse accelerations in space flight is discussed from the point of view of hemodynamics. E.K.R.

N64-23312 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ANALYZING THE EFFECT OF PHYSICAL LOAD, HIGH TEMPERATURE OF THE MEDIUM AND HIGHER OXYGEN CONTENT IN INHALED AIR ON THE EXCITABILITY OF HUMAN VISUAL ANALYZER

A. O. Navakatikyan, V. V. Lebedeva, I. N. Blageveschenskaya, and S. A. Pevnyy 3 Dec. 1963 14 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (Moscow), v. 49, no. 9, 1963 p 1036–1043
(FTD-TT-980/1+2; AD-427261)

The effect of a combination of conditions, characteristic of mine rescue operations (temperatures of surrounding medium, physical strains, and inhalation of gaseous mixtures with high oxygen content) on the vision of humans was investigated. The results of the experiments that were performed in a thermal chamber on two groups of subjects, miners and students, are presented. R.T.K.

N64-23335 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SOME RESULTS AND PROBLEMS IN THE FIELD OF SPACE RADIOBIOLOGY

P. P. Saksonov, V. V. Antunov, and N. N. Dobrov 23 Mar. 1964 14 p refs Transl. into ENGLISH from Vestnik Akad. Med. Nauk SSSR (Moscow), no. 8, 1963 p 13–20
(FTD-TT-64-33/1+2+4; AD-435994)

The influence of cosmic radiation on both the vital activity and heredity of biological organisms was studied. Monitoring dosimeters were set up onboard spaceships. The cosmonauts were also supplied with various kinds of personal dosimeters. Various biological objects were also put in the spaceships—lysogenic bacteria, cultures of HeLa cells, fruit flies, plant seeds, racemes of *Tradescantia paludosa*, fertilized eggs, and ascarid eggs. According to the dosimeters, Nikolaev received a dose of 0.5 rem and Popovich about 0.4 rem. At the same time, the results obtained on the biological organisms indicate a biological effect somewhat in excess of that anticipated from the recordings of the physical dose of cosmic radiation. The cosmic radiation dose during the entire time of the flight, as recorded by the physical and biological objects, did not adversely affect the cosmonauts. R.T.K.

N64-23366 Joint Publications Research Service, Washington, D.C.

STUDIES IN TOXICOLOGY

17 Jun. 1964 34 p refs Transl. into ENGLISH of 4 Articles from Gigiena Truda i Prof. Zabolevaniya (Moscow), v. 8, no. 4, Apr. 1964 p 19–29, 57–62
(JPRS-25116; OTS-64-31498) OTS: $1.00

CONTENTS:

1. SIGNIFICANCE OF THE CONCEPTS OF "TWO-PHASE TOXICITY" AND "THERMODYNAMIC ACTIVITY" IN TOXICOLOGY N. V. Lazarev and W. A. Filov p 1–9 refs (See N64-23367 16-16)

2. INVESTIGATIONS OF THE EFFECT OF VANADIUM TRIOXIDE DUST ON THE ORGANISM I. V. Roshchin, A. V. Il'nitskaya, La. A. Lutsenko, and L. V. Zhidkova p 10–18 refs (See N64-23368 16-16)

3. TOXIC PROPERTIES OF GERMANIUM TETRACHLORIDE I. N. Kal'sada p 19–26 refs (See N64-23369 16-16)

4. TOXICOLOGY OF AMINES OF THE HIGHER ALIPHATIC SERIES (16—20 CARBON ATOMS) N. G. Demeshkevich p 27–31 (See N64-23370 16-16)

N64-23367 Joint Publications Research Service, Washington, D.C.

SIGNIFICANCE OF THE CONCEPTS OF "TWO-PHASE TOXICITY" AND "THERMODYNAMIC ACTIVITY" IN TOXICOLOGY

N. V. Lazarev and V. A. Filov *In its* Studies in Toxicol. 17 Jun. 1964 p 1–9 refs (See N64-23366 16-16) OTS: $1.00

The concepts of two-phase toxicity and thermodynamic activity are related to one another in a definite manner. The first concept makes it possible to predict the actual danger of acute poisoning with volatile substances and to plot a comparative scale of such actual danger for substances during their free evaporation. The second concept opens possibilities for predicting the force of the narcotic action of the nonstudied members of a series on the basis of members that have been studied. In addition, the concept of the activity can be utilized for the approximate classification of substances by type of their narcotics action. P.V.E.

N64-23368 Joint Publications Research Service, Washington, D.C.

INVESTIGATIONS OF THE EFFECT OF VANADIUM TRIOXIDE DUST ON THE ORGANISM

I. V. Roshchin, A. V. Il'nitskaya, L. A. Lutsenko, and L. V. Zhidkova *In its* Studies in Toxicol. 17 Jun. 1964 p 10–18 refs (See N64-23366 16-16) OTS: $1.00

An experimental study of the action of vanadium trioxide dust is discussed. The investigation included a study of the physical properties of the dust, establishment of the average lethal dose, and a study of the nature of the toxic action of the aerosol in continuous experiments with rabbits. P.V.E.

N64-23369 Joint Publications Research Service, Washington, D.C.

TOXIC PROPERTIES OF GERMANIUM TETRACHLORIDE

I. N. Kal'sada *In its* Studies in Toxicol. 17 Jun. 1964 p 19–26 refs (See N64-23366 16-16) OTS: $1.00

The vapors of germanium tetrachloride have a sharp suffocating odor, and they irritate the mucous membranes of the respiratory passages and the conjunctiva of the eye. A study of germanium tetrachloride was conducted in three areas: (1) clarification of the toxicity of the compound during a static, single exposure, by observation of the clinical symptoms of the poisoning through determination of weight coefficients and through pathomorphological investigation of the organs; (2) investigation of the action of small concentrations of germanium

tetrachloride under conditions of dynamic exposure, by observation of the general condition of the organs and through investigation of the dynamics of the organ weight and by pathomorphological studies of the organs; and (3) local action of the compound on the integuments and the eye. P.V.E.

N64-23370 Joint Publications Research Service, Washington, D.C.
TOXICOLOGY OF AMINES OF THE HIGHER ALIPHATIC SERIES (16–20 CARBON ATOMS)
N. G. Demeshkevich *In its* Studies in Toxicol. 17 Jun. 1964 p 27–31 (See N64-23366 16-16) OTS: $1.00

Preliminary data are presented that were obtained from experiments in which a mixture of higher aliphatic amines with 16 to 20 carbon atoms were introduced into the stomach and applied to the skin of aminals (mice, rats, and rabbits). The amines used were as follows: hexadecylamine, $CH_3(CH_2)_{15}NH_2$; heptadecylamine, $CH_3(CH_2)_{16}NH_2$; octadecylamine, $CH_3(CH_2)_{17}NH_2$; nonandecylamine, $CH_3(CH_2)_{18}NH_2$; and eicosylamine, $CH_3(CH_2)_{19}NH_2$. P.V.E.

N64-23377 National Inst. of Mental Health, Bethesda, Md. Lab. of Neurobiology
A COMPARISON BETWEEN AUTONOMIC AND SOMATIC MOTOR OUTFLOW TO VESTIBULAR STIMULATION
Bo E. Gernandt (NASA. Ames Res. Center) Repr. from Confin. Neurol. (Basel), v. 24, 1964 p 140–157
(NASA-RP-215)

Reported is an investigation designed to compare the effects of removal of various tonic inhibitory sources upon the activity invoked by vestibular stimulation while recording simultaneously from the vagus nerve and spinal motor neurons. Discussed also are the results of a search for phasic control of autonomic activity evoked by vestibular stimulation. N.E.A.

N64-23391* Communication Research Inst., Miami, Fla.
BASIC RESEARCH ON BIOLOGICAL COMMUNICATION Progress Report, 1 Jul. 1962–31 Jan. 1964
John C. Lilly 1964 16 p
(Grant NsG-278-62)
(NASA-CR-53228) OTS: $1.60 ph

Experiments were designed to test the communication capabilities of *Tursiops truncatus*, an organism with a very large central nervous system. Investigations have been initiated on the natural underwater productions and of the elicited airborne sounds. The orientation that has gradually evolved is that of seeking physically specifiable aspects of sonic exchanges between organisms. The advantage of physically specifiable variables is that no psychophysical judgments are necessary to obtain agreement as to certain aspects of the observed phenomena. The major effort in this project has been to explore several such physical variables. Author

N64-23392* Esso Research and Engineering Co., Linden, N.J.
DEVELOPMENT OF HYDROCARBON ANALYSES AS A MEANS OF DETECTING LIFE IN SPACE Annual Report
W. G. Meinschein 1 Jan. 1964 10 p refs
(Contract NASw-508)
(NASA-CR-53096) OTS: $1.10 ph

Extensive data are being acquired on biological, sedimentary, and abiotic alkanes. More than 300 GLC chromatographic "fingerprints," 100 mass spectra, and many infrared and ultraviolet spectra of naturally occurring hydrocarbons have been catalogued. These data indicate that biotic hydrocarbons are readily distinguishable from adiotic alkanes. Benzene extracts of elimination products and of Recent sediments contain comparable percentages of alkanes. These percentages usually exceed greatly the concentrations of alkanes in biological lipids but are significantly less than the concentrations of alkanes in ancient sediment extracts or crude oils. Paraffinic hydrocarbons from living things, fecal matter, and sediments have similar structures and optical properties. Analyses of alkanes of various geologic ages show that different types of biological alkanes can apparently keep their characteristics for more than a billion years in terrestrial environments. Author

N64-23393* George Washington U., Washington, D.C.
EXOBIOLOGY Annotated Bibliography, 1951–1964
Joe W. Tyson and Ruby W. Moats, comp. Mar. 1964 78 p refs
(Grant NsG-485)
(NASA-CR-53806) OTS: $7.60 ph

This annotated bibliography on exobiology includes descriptions of planetary environments, speculations on the existence of life and the forms that life may assume under such conditions, and mechanisms for the discovery of life forms (remote sensing). It is based to a large extent on considerations of chemical and biological evolution on the planet earth. Author and subject indexes are provided. R.T.K.

N64-23428 Air Forece Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DATA FROM THE CONFERENCE DEALING IN METHODS OF PHYSIOLOGICAL INVESTIGATIONS OF HUMAN BEINGS (SELECTED ARTICLES)
10 Dec. 1963 62 p Transl. into ENGLISH from Materialy Konferentsii po Metodam Fiziol. Issled. Cheloveka, Inst. Gigieny Tr. i Profzabolevaniy AMN SSSR, Moskovskoye Obshchestvo Fiziologon, 1962 p 12, 15–23, 32–36, 40–42, 65-68, 83–85, 88–89, 98–108, 163–165, 186–194, 199–202, and 207
(FTD-TT-63-916/1; AD-427298)

CONTENTS:

1. MATHEMATICAL DIFFERENTIATION OF CARDIOLOGICAL CHARACTERISTICS Ye. B. Babskiy and V. L Karpamn p 1–2
2. NEW DEVELOPMENTAL TRENDS IN MODERN PHYSIOLOGY N. A. Bernhteyn p 3–12
3. PRINCIPLES OF METHODICAL APPROACH TO THE STUDY OF HUMAN TYPES OF HIGHER NERVOUS ACTIVITY Z. I. Biryukova p 12–14
4. COMPLEX DECODER FOR MEDICINAL RADIOTELEMETRY V. A. Vayser and V. V. Rozenblat p 14–15
5. ON A METHOD OF TAKING EGG ON BRIDGE CRANE MACHINISTS OF HOT PLANTS IN THE PROCESS OF WORKING A. V. Vasilyeva p 15–17
6. RADIOTELEMETRIC INVESTIGATIONS OF HEART BEAT FREQUENCY AT SPORTS ACTIVITIES A. V. Vasilyeva p 17–18
7. ON THE POSSIBILITY OF ESTABLISHING BRIEF DISRUPTIONS IN THE RHYTHM OF THE HEART A. A. Viru and M. A. Epler p 18–19
8. EMPLOYMENT OF ELECTROENCEPHALOGRAPHY IN HYGIENIC INVESTIGATIONS AND METHODS OF ANALYZING SAME A. M. Volkov p 20–21
9. ELECTRONIC METHOD OF STUDYING RESPIRATION AT WORK P. I. Gumener p 22–23
10. METHOD OF STUDYING VEGETATIVE FUNCTIONS AMONG STUDENTS AT FUNCTIONAL ACTIVITIES P. I. Gumener and T. M. Studenetskaya p 23–25

11. VECTOR ANALYSIS OF DYNAMOCARDIOGRAMS L. A. Ioffe p 25–27

12. METHOD OF ELECTROMETRIC DETERMINATION OF OXYGEN IN EXHALED AIR OF HUMANS L. A. Isaakyan and V. A. Tarasov p 27–28

13. QUANTITATIVE METHODS OF INVESTIGATING HUMAN MUSCULAR TONUS Ya. M. Kots p 28–35

14. THE VELODYNAMOMETER L. G. Kuchin p 36–36

15. DYNAMOMETRIC BICYCLE PEDALS L. G. Kuchin p 36–37

16. COMPLEX INSTALLATION FOR STUDYING COORDINATIONS OF MOVEMENTS WHEN TURNING BICYCLE PEDALS L. G. Kuchin p 37–40

17. RADIOTELEMETRIC METHOD OF EXAMINING SPORTSMEN S. P. Sarychev p 40–42

18. REMOTE REGISTRATION BY THE METHOD OF TELEMETERING RESPIRATION, PULSE, EGG. I. I. Semernin and V. S. Sidorenko p 42–43

19. METHODICAL PROBLEMS OF PHYSIOLOGICALLY INVESTIGATING LABOR ACTIONS WITH CONTROL SYSTEMS V. S. Farfel' p 43–45

20. ON METHODS OF STUDYING MOVEMENTS, ASSURING URGENT INFORMATION ABOUT THE MEASURED PARAMETERS V. S. Farfel' p 45–49

21. NEW SOUND ABSORBING EAR MUFFS AND METHOD OF INVESTIGATING THEIR EFFECTIVENESS A. V. Chapek and V. V. Ushakov p 49–51

22. ABOUT CERTAIN METHODS OF INVESTIGATION DIURNAL PERIODICITY OF PHYSIOLOGICAL FUNCTIONS OF THE ORGANISM OF CIVIL AVIATION FLIGHT PERSONNEL A. V. Chapek and I. M. Geller p 51–52

23. PROBLEMS OF EVALUATING MAN'S EXTERNAL RESPIRATION FUNCTIONS L. L. Shik p 53–57

24. ON HOW TO DETERMINE AND INCREASE THE RESISTANCE OF THE ORGANISM TO ROLLING BY THE METHOD OF RAPID HEAD MOVEMENTS A. I. Yarotskiy p 57–58

N64-23432 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MICROBIOLOGY (SELECTED ARTICLES)

19 Nov. 1963 18 p refs Transl. into ENGLISH from Mikrobiologiya (Moscow), v. 32, no. 2, 1963 p 193–203
(FTD-TT-63-1009/1+2; AD-425809)

CONTENTS:

1. EFFECT OF LIGHT INTENSITY ON THE USE OF CO_2 AND ORGANIC COMPOUNDS DURING THE PHOTOSYNTHESIS OF CHLOROPSEUDOMONAS ETHYLICUM R. M. Baltiskaya and Ye. N. Kondratyeva p 1–9 refs (See N64-23433 16-16)

2. ON THE RELATIONSHIP BETWEEN THE PHYSIOLOGICAL STATE AND MEDIUM DURATION OF FLUORESCENCE OF BACTERIOCHLOROPHYLL IN CELLS OF PHOTOSYNTHESIZING BACTERIA A. B. Rubin and L. K. Osnitskaya p 10–15 refs (See N64-23434 16-16)

N64-23433 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE EFFECT OF LIGHT INTENSITY ON THE USE OF CO_2 AND ORGANIC COMPOUNDS DURING THE PHOTOSYNTHESIS OF CHLOROPSEUDOMONAS ETHYLICUM

R. M. Balitskaya and Ye. N. Kondratyeva *In its* Microbiology (Selected Articles), 19 Nov. 1963 p 1–9 refs (See N64-23432 16-16)

Use of organic compounds and carbon dioxide by *Chloropseudomonas ethylicum* varies in relation to light intensity. At low light intensities, the culture oxidizes ethanol into acetic acid and fixes CO_2 in equimolecular ratios. Upon an increase in light intensity, the ratio CO_2/C_2H_5OH rises gradually to 1.85, and the ratio CH_3COOH/C_2H_5OH drops to 0.23. The amount of consumed ethanol and CO_2 per 1 g of dry bacteria weight decreases with the increase in light intensity, which, apparently, is compensated by the use of acetic acid by the culture in exchange. The use of glucose by the *Chloropseudomonas ethylicum* is accompanied by the formation in the medium of small CO_2 quantities at light intensities of approximately up to 25×10^3 erg/cm^2 sec. At a further increase in light intensity, the use of glucose by *Chloropseudomonas ethylicum* is not accompanied by formation or consumption of CO_2 from the medium. P.V.E.

N64-23434 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE RELATIONSHIP BETWEEN THE PHYSIOLOGICAL STATE AND MEDIUM DURATION OF FLUORESCENCE OF BACTERIOCHLOROPHYLL IN CELLS OF PHOTOSYNTHESIZING BACTERIA

A. B. Rubin and L. K. Osnitskaya *In its* Microbiology (Selected Articles), 19 Nov. 1963 p 10–15 refs (See N64-23432 16-16)

The mean duration of the singlet excited state of pigments in photosynthesizing bacteria was investigated in order to determine the effectiveness of photosynthetic deactivation of excited pigment molecules. P.V.E.

N64-23437 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE UNIVERSAL UNIT OF RADIATION DOSE

V. I. Ivanov 30 Dec. 1963 10 p refs Transl. into ENGLISH from Ob Universal'noy Edinitse Radiatsionnoy Dozy, Symposium on Biological Effects of Neutron Irradiations (USSR), 7–11 Oct. 1963 9 p
(FTD-TT-63-1050/1+2+4; AD-430126)

A universal value of the radiation dosage is introduced, which, at a biological dose of 1 rem, has the same value for any type of radiation regardless of its spectrum. A special feature of the radiation dose is that it depends only on the physical values determining the interaction between the radiation and the substance. The new magnitude dosage radiation is determined by the relationship, $\omega^* = \beta_1 \Delta E + \beta_2 \sqrt{\Delta E}\, dE/dx$, where ω^* is the radiation dosage; dE/dx is the average energy loss per unit pathway of a secondary particle, defined as the quotient from the division of the total energy of the particle divided by its path length; and β_1 and β_2 are constant coefficients selected so that the ω^* equals unity at a neutron dose of 1 rem. P.V.E.

N64-23444 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

RECORDERS IN ELECTROMEDICAL DIAGNOSTIC APPARATUS

B. N. Liushits and N. A. Solov'yev 23 Mar. 1964 10 p ref Transl. into ENGLISH from Elektron. V Med., Gosenergoizdat (Moscow), 1960 p 130–136
(FTD-TT-63-1195/1+2+4; AD-438825)

The recorder is one of the basic units of a clinical electromedical diagnostic apparatus. Recorders with photorecording from the screen of a cathode-ray or by means of electromechanical oscillographs are described. The characteristics of magnetoelectric and polarized electromagnetic recording systems are discussed. R.T.K.

N64-23454 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HERALD OF THE ACADEMY OF SCIENCES OF THE USSR (SELECTED ARTICLES)
31 Jan. 1963 35 p Transl. into ENGLISH from Vestnik Akad. Med. Nauk SSSR (Moscow), no. 4, 1962 p 44–50, 65–70, 76–81
(FTD-TT-62-1164/1+2+4; AD-295282)

CONTENTS:

1. ADAPTIVE REACTIONS OF AN ORGANISM UNDER OCCUPATIONAL CONDITIONS A. A. Letavet p 1–12
2. EXPERIMENTAL BIOLOGY AND NEW CONCEPTS OF IMMUNOGENESIS N. N. Zhukov-Vereahnikov, I. N. Mayskiy, et al p 13–21 (See N64-23455 16-16)
3. POSSIBILITIES OF PROTECTIVE ADAPTATIONS OF AN ORGANISM AND THEIR LIMITS UNDER CONDITIONS OF MAXIMUM C-FORCES AND WEIGHTLESSNESS V. V. Parnin, et al p 22–32 (See N64-23456 16-16)

N64-23455 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EXPERIMENTAL BIOLOGY AND NEW CONCEPTS OF IMMUNOGENESIS
N. N. Zhukov-Verezhnikov, I. N. Mayskiy, and G. P. Tribulev *In its* Herald of the Acad. of Sci. of the USSR (Selected Articles) 31 Jan. 1963 p 13–21 (See N64-23454 16-16)

Recent hypotheses dealing with the formation of antibodies are discussed. The mutation-clone theory of the formation of Burnet antibodies is considered in particular. P.V.E.

N64-23456 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
POSSIBILITIES OF PROTECTIVE ADAPTIONS OF AN ORGANISM AND THEIR LIMITS UNDER CONDITIONS OF MAXIMUM G-FORCES AND WEIGHTLESSNESS
V. V. Parnin, O. G. Gazenko, and V. I. Yazdovskiy *In its* Herald of the Acad. of Sci. of the USSR (Selected Articles) 31 Jan. 1963 p 22–32 (See N64-23454 16-16)

The effects of acceleration and weightlessness on man and other organisms are discussed. Various experiments involving animals are described. Also described are the effects of weightlessness noted in cosmonauts Gagarin and Titov. P.V.E.

N64-23463 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HERALD OF THE ACADEMY OF MEDICAL SCIENCES OF THE USSR (SELECTED ARTICLES)
20 Feb. 1963 45 p Transl. into ENGLISH from Vestnik Akad. Med. Nauk SSSR (Moscow), no. 5, 1962 p 72–93
(FTD-TT-62-1548/1+2+4; AD-299646)

CONTENTS:

1. AN EXPERIMENT IN THE ANALYSIS OF PROTECTIVE ORGANIC FUNCTIONS BASED ON THEORETICAL CONCEPTS OF REGULATION AND PHYSIOLOGY B. I. Al'bertinskiy, G. S. Kan, and V. N. Chernigovskiy p 1–28 (See N64-23464 16-16)
2. GENERAL ADAPTATION REACTIONS IN AN ORGANISM EXPOSED TO HARMFUL STIMULI I. R. Petrov p 29–42 (See N64-23465 16-16)

N64-23464 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AN EXPERIMENT IN THE ANALYSIS OF PROTECTIVE ORGANIC FUNCTIONS BASED ON THEORETICAL CONCEPTS OF REGULATION AND PHYSIOLOGY (INSTANCED BY TUBERCULAR INFECTION)
B. I. Al'bertinskiy, G. S. Kan, and V. N. Chernigovskiy *In its* Herald of the Acad. of Med. Sci. of the USSR (Selected Articles) 20 Feb. 1963 p 1–28 refs (See N64-23463 16-16)

The reaction of an organism to exposure to tubercular infection is examined, and the general laws of establishing defense mechanisms are discussed with respect to several general concepts of physiology and control theory. It is concluded that postvaccinal immunity to tuberculosis in its physiological aspect is the result of the organism's active adaptation in relation to BCG (bacillus Calmette–Guérin vaccine, and adaptation that leads to homeostasis disturbed by the original administration of vaccine. In its biological aspect, immunity is the result of transferring the organism in the process sustaining homeostasis to a new level of control. P.V.E.

N64-23465 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
GENERAL ADAPTATION REACTIONS IN AN ORGANISM EXPOSED TO HARMFUL STIMULI
I. R. Petrov *In its* Herald of the Acad. of Med. Sci. of the USSR (Selected Articles) 20 Feb. 1963 p 29–42 refs (See N64-23463 16-16)

Under the action of harmful stimuli during the rise and course of a disease two types of change are discovered—adaptive reactions and pathological changes, which are closely interconnected and represent a single complex characteristic of the given disease. Brief summaries of experiments are presented, indicating that these changes do occur. P.V.E.

N64-23618 Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Research Inst.
THE FLAMMABILITY OF LIP, FACE AND HAIR PREPARATIONS IN THE PRESENCE OF 100% OXYGEN
J. Robert Dille, Charles R. Crane, and George E. Pendergrass Nov. 1963 7 p refs
(CARI-63-27)

The effects of high concentrations and pressures of oxygen and of static sparks upon lip, face, and hair preparations were determined because of questions that frequently arise and apprehension that exists. A wide margin of safety was found in their use at or below one atmosphere of pressure. However, their use in experimental or therapeutic compressions is not deemed safe due to a marked increase in the effects of a static spark upon these compounds at two atmospheres oxygen pressure. Auth.

N64-23619 Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Research Inst.
SIZE CUES AND THE ADJACENCY PRINCIPLE
Walter C. Gogel Nov. 1963 10 p refs
(CARI-63-28)

The purpose of the present study was to apply the adjacency principle to the perception of relative depth from size cues. In agreement with the adjacency principle, it was found that the size cue between adjacent objects was more effective than the size cue between displaced objects in determining the perceived relative depth position of objects. An additional, although minor, factor concerned with task-set was tentatively identified as contributing to the perception of depth from size cues. Auth.

N64-23638 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
LIFE ON A SATELLITE
P. Isakov *In its* Stations in Space 10 Feb. 1964 p 12-22 (See N64-23634 16-01)

This is a report of astronautical behavior, intrinsic and imposed, aboard a spacecraft. The author discusses weightlessness, radiation hazard, acceleration, and problems concerned with oxygenation and respiratory processes. Data are drawn for the most part from the information gained from the first three Soviet satellite launchings. A.W.

N64-23655 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MICROBIOLOGY Selected Articles
14 Nov. 1963 35 p refs Transl. into ENGLISH from Mikrobiologiya (Moscow), v. 32, no. 4, 1963 p 582-597, 727-731 (FTD-TT-63-1016/1+2; AD-425493)

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1. EFFECT OF CONCENTRATIONS OF VARIOUS MEDIUM COMPONENTS ON THE GROWTH AND NITROGEN-FIXATION OF BLUISH-GREEN ALGAE M. S. Takha p 1-12 ref (See N64-23656 16-16)

2. EFFECT OF ILLUMINATION AND TEMPERATURE ON THE FORMATION DUNALIELLA SALINA PIGMENT Ye. S. Mil'ko p 13-23 refs (See N64-23657 16-16)

3. AUTOMATIC TEMPERATURE CONTROL SYSTEMS V. N. Chernov, V. P. Drevush, and I. F. Van'shev p 24-30 (See N64-23658 16-16)

N64-23656 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF CONCENTRATIONS OF VARIOUS MEDIUM COMPONENTS ON THE GROWTH AND NITROGEN-FIXATION OF BLUISH-GREEN ALGAE
Mokhamed Samekh Takha *In its* Microbiology 4 Nov. 1963 p 1-12 refs (See N64-23655 16-16)

The optimal concentration of Fe, P, K, Ca, Mo, and bicarbonate for growth and nitrogen fixation by three cultures of blue-green algae was determined. A new medium for culturing blue-green algae is suggested. Changes in the pH of the new medium, in growth, and in the nitrogen fixed during the growth, of *Hapalosiphon fontinalis, Anabaena variabilis,* and *Calothrix elenkinii,* is recorded. G.D.B.

N64-23657 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF ILLUMINATION AND TEMPERATURE ON THE FORMATION OF DUNALIELLA SALINA PIGMENT
Ye. S. Mil'ko *In its* Microbiology 4 Nov. 1963 p 13-23a refs (See N64-23655 16-16)

Increases in luminosity resulted in decreases in the concentration of chlorophyll in *Dunaliella salina* cells. Temperature rises also caused decreases in chlorophyll concentration. Certain optimum conditions are described for proper pigmentation. G.D.B.

N64-23658 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AUTOMATIC TEMPERATURE CONTROL SYSTEMS
V. N. Chernov, V. P. Drevush, and I. F. Van'shev *In its* Microbiology 14 Nov. 1963 p 24-30 (See N64-23655 16-16)
(FTD-TT-63-1016)

Described is a system assuring automatic temperature control at a given level of the enclosed volume that is intended for the creation of necessary temperature conditions for cultivating microorganisms. The system with intermediate relay assures reliable operation for a long time and can be recommended for application. G.D.B.

N64-23659 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEWS OF THE ACADEMY OF SCIENCES OF THE USSR. BIOLOGICAL SERIES Selected Articles
4 Dec. 1963 22 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Ser. Biol., no. 5, Sep.-Oct. 1963 p 719-723, 746-754
(FTD-TT-63-1052/1+2; AD-427153)

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1. ROLE OF NUCLEINIC ACIDS AND ALBUMIN IN INDUCED BIOSYNTHESIS OF CHLOROPHYLL Yu. G. Molotkovskiy and V. F. Moryakova p 1-8 refs (See N64-23660 16-16)

2. BIOELECTRIC ACTIVITY OF SKELETAL MUSCULATURE UNDER CONDITIONS OF INTERMITTENT EFFECT OF OVERLOADS AND WEIGHTLESSNESS Ye. M. Yuganov, I. I. Kas'yan, and B. F. Asyamolov p 9-19 refs (See N64-23661 16-16)

N64-23660 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ROLE OF NUCLEINIC ACIDS AND ALBUMIN IN INDUCED BIOSYNTHESIS OF CHLOROPHYLL
Yu. G. Molotkovskiy and V. F. Moryakova *In its* News of the Academy of Sciences of the USSR, Biological Series, 4 Dec. 1963 p 1-8 refs (See N64-23659 16-16)

The assumption that synthesis of specific RNA is induced in green plants by the effect of light has been tested using inhibiting analysis. The process supposedly leads to the synthesis of chloroplast albumina, with the final formation of chlorophyll. The effects of uracil antimetabolites, of adenine and uracil, and of chloramphenicol on RNA and albumin synthesis were studied by using bean sprouts. The data show that light-induced formation of chloroplasts and, later, chlorophyll can be transformed through nucleic acid and albumin exchange. D.E.R.

N64-23661 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BIOELECTRIC ACTIVITY OF SKELETAL MUSCULATURE UNDER CONDITIONS OF INTERMITTENT EFFECT OF OVERLOADS AND WEIGHTLESSNESS
Ye. M. Uganov, I. I. Kasyan, and B. F. Asyamolov *In its* News of the Academy of Sciences of the USSR, Biological Series, 4 Dec. 1963 p 9-19 refs (See N64-23659 16-16)

The state of bioelectric activity of animal and human musculature under the intermediate effect of overloads and weightlessness to 2 units and for 25 to 30 seconds has been investigated. It was found that conditions of weightlessness produced a sharp reduction in the bioelectric activity of skeletal musculature, pointing to the possibility of changing muscle tonus. Overloads caused no such change. The dependence of the observed changes on the functions of the vestibular analyzer also was determined. D.E.R.

N64-23694 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BULLETIN OF EXPERIMENTAL BIOLOGY AND MEDICINE (SELECTED ARTICLES)

13 Nov. 1963 31 p refs Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), v. 6, no. 8, 1963 p 11–13, 28–37, 116–120
(FTD-TT-63-1013/1+2; AD-424606)

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1. STUDYING HUMAN TASTE SENSITIVITY UNDER PROLONGED OXYGEN RESPIRATION WITH A PERTINENT DIETARY N. S. Zayko, M. I. Kuznetsov, and N. A. Chelnokova p 1–5 refs (See N64-23695 16-16)

2. ON TRACTIONS OF THE ORGANISM DURING PROLONGED ACTION OF CORIOLIS ACCELERATIONS N. I. Arlashchenko, B. B. Bokhov, V. Ye. Busygin, N. A. Volokhova, Yu. G. Grigoryev et al p 6–12 refs (See N64-23696 16-16)

3. PHYSIOLOGICAL REACTIONS OF THE HUMAN ORGANISM EXPOSED TO THE EFFECTS OF MAXIMUM IN TIME AND MAGNITUDE ACCELERATIONS DIRECTED ALONG THE DORSO-THORACIC AXIS A. S. Barer, G. A. Golov, and Ye. I. Sorokina p 13–19 refs (See N64-23697 16-16)

4. USE OF AUTOMATIC LOGICAL DEVICES (COMPUTERS) FOR MEDICAL CONTROL R. M. Bayevskiy, Ye. A. Zil'bertal, V. M. Kruzenshtern, and V. R. Freydel' p 20–28 refs (See N64-23698 16-16)

N64-23695 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

STUDYING HUMAN TASTE SENSITIVITY UNDER PROLONGED OXYGEN RESPIRATION WITH A PERTINENT DIETARY

N. S. Zayko, M. I. Kuznetsov, and N. A. Chelnokova *In its* Bull. of Exptl. Biol. and Med. 13 Nov. 1963 p 1–5 refs (See N64-23694 16-16)

No changes occur in the taste sensitivity of humans placed in a barochamber with an atmospheric pressure corresponding to the altitude of 5,500 m and given to breath a gas mixture with an increased oxygen content for 2.5 to 8 hr; this points to the normal digestive tract function. This method of determining the functional mobility of the taste receptor apparatus may be used to study nutritional problems in prolonged high-altitude flights. Author

N64-23696 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON TRACTIONS OF THE ORGANISM DURING PROLONGED ACTION OF CORIOLIS ACCELERATIONS

N. I. Arlashchenko, B. B. Bokhov, V. Ye. Busygin, N. A. Volokhova, Yu. G. Grigoryev et al *In its* Bull. of Exptl. Biol. and Med. 13 Nov. 1963 p 6–12 refs (See N64-23694 16-16)

This report describes investigations of corresponding reactions among people in a slowly rotating chamber to determine the reactions of the organism in response to prolonged effect of Coriolis accelerations. G.D.B.

N64-23697 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PHYSIOLOGICAL REACTIONS OF THE HUMAN ORGANISM EXPOSED TO THE EFFECTS OF MAXIMUM IN TIME AND MAGNITUDE ACCELERATIONS DIRECTED ALONG THE DORSO-THORACIC AXIS

A. S. Barer, G. A. Golov, and Ye. I. Sorokina *In its* Bull. of Exptl. Biol. and Med. 13 Nov. 1963 p 13–19 refs (See N64-23694 16-16)

An inquiry was made into the chief indices of external respiration in man during the action of accelerations (up to 15 g) directed along the dorsothoracic axis at an angle of 65° to the back of the armchair. A definite regularity was established in the changes of the indices studied with various accelerations. Definite stages were noted in the development of individual reactions; this regularity reflected the essence of the general biological laws concerning body adaptation to new environmental conditions. Author

N64-23698 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

USE OF AUTOMATIC LOGICAL DEVICES (COMPUTERS) FOR MEDICAL CONTROL

R. M. Bayevskiy, Ye. A. Zil'Bertal', V. M. Kruzenshtern, and V. R. Freydel' *In its* Bull. of Exptl. Biol. and Med. 13 Nov. 1963 p 20–28 refs (See N64-23694 16-16)

An automatic logical device for simultaneous control of six physiological parameters in the form of levels of tension or impulses is described. The information is evaluated by automatic determination of one of the three possible conditions: norm, increase, decrease. After comparing the conditions of all the parameters according to a preset algorithm, a coded conclusion is formed. Analyzed is the work program of the automatic logical device for the urgent diagnosis of acute cardiac insufficiency, syncope, and collapse. Author

N64-23700 Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Research Inst.

ACUTE AND CHRONIC EFFECTS OF THE INSECTICIDE ENDRIN ON RENAL FUNCTION AND RENAL HEMODYNAMICS

D. A. Reins, D. D. Holmes, and L. B. Hinshaw Oct. 1963 11 p refs
(CARI-63-26)

Chronic and acute effects of the insecticide endrin on renal function were studied in dogs. Animals were exposed to endrin chronically by intramuscular injection and acutely by intravenous infusion. In acute studies, dogs developed systemic hypertension and increased renal vascular resistance attributable to a sympatho-adrenal action. Basic renal autoregulation was not impaired by endrin but was masked by effects of blood-borne adrenergic agents. Changes in renal function were minimal. In chronic studies, dogs developed progressive systemic hypotension with variable changes in renal function and terminal renal vasodilation in some instances. Pathological findings were minimal and could be related to hemodynamic alterations in the peripheral vasculature. Results from this investigation provide no evidence for renal failure due to chronic insecticide poisoning. Author

N64-23734 Joint Publications Research Service, Washington, D.C.

PROBLEMS OF SPACE BIOLOGY

N. M. Sisakyan and V. I. Yazdovskiy, ed. 29 Jun. 1964 555 p refs Transl. into ENGLISH of the Book "Problemy Kosmicheskoy Biologii vol. III Moscow, 1964 p 3–490
(JPRS-25287; TT-64-31578) OTS: $7.00

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Chernigovskiy, and V. I. Yazdovskiy p 21–34 refs (See N64-23737 16-16)

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N64-23735 Joint Publications Research Service, Washington, D.C.

THE MAIN SCIENTIFIC TRENDS OF SPACE BIOLOGY IN THE CONQUEST OF SPACE

V. I. Yazdovskiy *In its* Probl. of Space Biol. 29 Jun. 1964 p 3–6 (See N64-23734 16-16) OTS: $7.00

Special attention is paid to the study of a complex influence of space flight factors that could not be imitated completely on earth. In this connection the necessity of gaining wide experience in collecting scientific data in real flights is pointed out. Author

N64-23736 Joint Publications Research Service, Washington, D.C.

PHYSICAL CONDITIONS OF SPACE FLIGHT AND A BIOLOGICAL CHARACTERIZATION OF THEM

Yu. M. Volynkin and P. P. Saksonov *In its* Probl. of Space Biol. 29 Jun. 1964 p 7–20 refs (See N64-23734 16-16) OTS: $7.00

The paper considers physical conditions of space flight and analyzes the data collected concerning biological effects of those conditions. Physical factors affecting living beings (man included) during space flight are divided into three groups: factors characterizing cosmic space as outer medium (vacuum, ionizing radiation, sharp differences in temperature, etc.); factors of rocket flight dynamics (noise, vibration, accelerations, and weightlessness); and factors characteristics of a long-term stay in a spacecraft cabin (artificial atmosphere, limitation of movements, isolation, peculiar food, etc). The biological action in rarefied atmosphere, ionizing radiation, and weightlessness is discussed in detail. Author

N64-23737 Joint Publications Research Service, Washington, D.C.

BIOLOGICAL AND PHYSIOLOGICAL STUDIES IN ROCKET AND SATELLITE FLIGHTS

O. G. Gazenko, V. N. Chernigovskiy, and V. I. Yazdovskiy *In its* Probl. of Space Biol. 29 Jun. 1964 p 21–34 refs (See N64-23734 16-16) OTS: $7.00

Summarized data concerning biomedical experiments carried out by Soviet scientists on board the rockets, artificial earth's satellites, and spaceships are presented. The results of Yu. A. Gagarin and G. S. Titov's flights are fully described. Some preliminary information obtained during a group space flight made by A. G. Nikolayev and P. R. Popovich is considered. Author

N64-23738 Joint Publications Research Service, Washington, D.C.

BASIC PROBLEMS IN THE STUDY OF WEIGHTLESSNESS

V. I. Yazdovskiy, I. I. Kas'yan, and V. I. Kopanev *In its* Probl. of Space Biol. 29 Jun. 1964 p 35–58 refs (See N64-23734 16-16) OTS: $7.00

The authors present summarized experimental and literature data related to the problem of weightlessness. Principal pathways in the investigation of the problem are outlined. The influence of weightlessness upon human and animal organisms is elucidated. Author

N64-23739 Joint Publications Research Service, Washington, D.C.

SOME PRINCIPLES IN THE FORMATION OF AN ARTIFICIAL HABITAT IN SPACE SHIP CABINS

A. M. Genin *In its* Probl. of Space Biol. 29 Jun. 1964 p 59–65 (See N64-23734 16-16) OTS: $7.00

When creating experimental manned spacecraf there should necessarily be made a compromise between the requirements for maximal comfort for the crew and possibilities provided by modern techniques. However, the increase of the duration of space flight does not allow for a reduction of hygienic requirements for the artificial medium, and at the same time it complicates its conditioning. Several criteria for an artificial medium and methods of its attainment during flights of various duration are considered. Author

N64-23740 Joint Publications Research Service, Washington, D.C.

THE BASIC PROBLEMS OF ENGINEERING PSYCHOLOGY OF SPACE FLIGHT

V. G. Denisov, A. P. Kuz'minov, and V. I. Yazdovskiy *In its* Probl. of Space Biol. 29 Jun. 1964 p 66–78 refs (See N64-23734 16-16) OTS: $7.00

Three main lines in engineering psychology are determined: (1) study of psychophysiological capacity of man under conditions of space flight; (2) development of requirements for the operation systems, taking into consideration functional characteristics of a human operator; and (3) development of methods to train cosmonauts for operating spacecraft systems. Author

N64-23741 Joint Publications Research Service, Washington, D.C.

PROBLEMS OF THE PHYSIOLOGICAL INTERACTION OF ANALYZERS AS APPLIED TO SPACE FLIGHTS

V. I. Yazdovskiy and M. D. Yemel'yanov *In its* Probl. of Space Biol. 29 Jun. 1964 p 79–87 refs (See N64-23734 16-16) OTS: $7.00

Hypotheses explaining the mechanism of vegetative disorders that may appear in the course of a prolonged space flight are discussed. The idea of physiological interaction between analyzers is presented and is confirmed to a certain degree by experimental data. The importance of the problem of the interaction of analyzers in relation to space flights is stressed, and a long-range program of investigations is suggested. Author

N64-23742 Joint Publications Research Service, Washington, D.C.

PROBLEM OF WASTE UTILIZATION ON LONG-TERM SPACE FLIGHTS

B. L. Gol'dshvend, B. G. Gusarov, A. G. Lobanov, Yu. Ye. Sinyan, A. P. Tereshchenko et al *In its* Probl. of Space Biol. 29 Jun. 1964 p 88–103 refs (See N64-23734 16-16) OTS: $7.00

It has been shown that a necessary part in a life-support system for space crew should be reutilization. Its function is to remove and process all body and other waste materials into substances suitable for direct employment in other parts of the life-support system. Possible ways to develop the system of reutilization on the basis of biological and physicochemical methods are discussed. Advantages and disadvantages of the methods are revealed. Author

N64-23743 Joint Publications Research Service, Washington, D.C.

REGENERATION OF WATER IN THE SPACESHIP CABIN

Yu. Ye. Sinyak and S. V. Chizhov *In its* Probl. of Space Biol. 29 Jun. 1964 p 104–114 refs (See N64-23734 16-16) OTS: $7.00

The development of an effective method of water regeneration that meets the demands in energy, weight, etc. will make it possible to considerably decrease the start weight of a life-support system for a space crew. A catalytic method of water regeneration from water-containing body wastes of animals and humans is proposed. Sanitary and hygienic tests of the water obtained by both catalytic and lyophilic methods have shown that its quality meets conventional requirements for potable water. Author

N64-23744 Joint Publications Research Service, Washington, D.C.

THE BASIC TRENDS IN THE STUDY OF THE BIOLOGICAL EFFECT OF COSMIC RADIATION AND THE SEARCH FOR MEANS OF PROTECTION AGAINST RADIATION

V. V. Antipov, N. N. Dobrov, and P. P. Saksonov *In its* Probl. of Space Biol. 29 Jun. 1964 p 115–128 refs (See N64-23734 16-16) OTS: $7.00

The paper proves that short flights along the orbits situated lower than the earth's radiation belts are not hazardous for man if no solar chromospheric outbursts occur. Nevertheless, during prolonged space flights along the orbits passing through near-earth radiation belts, especially in the period of solar flares that generate protons, cosmic radiation is one of the main obstacles in the way of conquering outer space. In this connection the immediate research tasks are the determination of relative biological activity of individual components of space radiation, the study of specificity of cosmic radiation in the biological action of a whole complex of space flight factors, the development of principles and means of physical and pharmaceutico-chemical protection of man and the entire biocomplex, the development of methods of physical and biological dosimetry, etc. Author

N64-23745 Joint Publications Research Service, Washington, D.C.

THE SETTING OF THE SPACESHIP CABIN

V. V. Zefel'd *In its* Probl. of Space Biol. 29 Jun. 1964 p 129–133 (See N64-23734 16-16) OTS: $7.00

The objects and space in either the cabin or orbital station represent an integral part of the environment of the crew. This part of the medium must contain characteristic elements of the everyday surroundings of their life on earth, which are related to important moments in the psychic life of the crew prior to the flight. This approach makes it possible to stimulate the normalization of the psychic and physical tonus of the cosmonauts through associations and thus to help the organisms resist the injurious action of monotonous flight rhythm and the sharp decrease in stimuli and impressions. Author

N64-23746 Joint Publications Research Service, Washington, D.C.

MEANS AND METHODS OF BIOMEDICAL RESEARCH IN SPACE FLIGHT

I. T. Akulinichev, L. F. Andreyev, R. M. Bayevskiy, A. Ye. Baynov, B. G. Buylov et al *In its* Probl. of Space Biol. 29 Jun. 1964 p 134–151 refs (See N64-23734 16-16) OTS: $7.00

Methods of physiological investigations and the medical radioelectronic instrumentation installed on board the Soviet satellites 2 and 3 and the Vostok spaceships are described. General requirements for onboard medical instrumentation are discussed. Peculiarities in design of sensors and electrodes are reported. Principal electric schemes of all measuring channels are presented. Author

N64-23747 Joint Publications Research Service, Washington, D.C.

SOME METABOLIC INDICES IN COSMONAUTS

T. A. Fedorova, L. T. Tutochkina, M. S. Uspenskaya, M. S. Skurikhina, and Ye. A. Fedorov *In its* Probl. of Space Biol. 29 Jun. 1964 p 152–168 refs (See N64-23734 16-16) OTS: $7.00

During the training period space pilots revealed peculiar changes in the protein composition of blood serum—a small increase in the relative albumin content and decrease in the content of α_2, β-, γ-globulins and mucoids. Urine showed a decrease in excretion of Dische-positive substances, a fall in

the enzymic activity of acid deoxyribonuclease, an increase in the amount of adrenal hormones (free 21-oxy-20-ketocorticosteroids) and, in some cases, mucoids. During rest the content of all these substances in blood and urine usually returned to normal. After the flight a total protein content in the blood of cosmonauts increased to the maximal normal level, or exceeded it, and during prolonged space flight the level of serum mucoids increased some what. Author

N64-23748 Joint Publications Research Service, Washington, D.C.
REACTIONS OF HUMAN BEINGS TO WEIGHTLESSNESS
L. A. Kitayev-Smyk *In its* Probl. of Space Biol. 29 Jun. 1964 p 169–177 refs (See N64-23734 16-16) OTS: $7.00

Responses of 193 persons were studied under the conditions of short-term weightlessness during flight. The responses that lessen human tolerance to a weightless state are psychic and vegetative. Illusory sensations occurring at the onset of weightlessness may enable the prediction of the character of subsequent disturbances. The adaptation to weightlessness is discussed. Author

N64-23749 Joint Publications Research Service, Washington, D.C.
EXCITABILITY OF THE HUMAN VESTIBULAR ANALYZER UNDER CONDITIONS OF SHORT-TERM WEIGHTLESSNESS
Ye. M. Yuganov and A. I. Gorshkov *In its* Probl. of Space Biol. 29 Jun. 1964 p 178–189 refs (See N64-23734 16-16) OTS: $7.00

During short-term weightlessness a state of excitability of the vestibular analyzer was studied; it was judged by changes in the character and degree of expression of vestibulosensoric and vestibulomotoric responses and was compared to the terrestrial circumstances under the influence of galvanic current, angle, and Coriolis accelerations. A method is proposed for reducing the excitability of the vestibular analyzer when exposed to the action of external stimuli during short-term weightlessness. Author

N64-23750 Joint Publications Research Service, Washington, D.C.
THE VESTIBULAR ANALYZER AND ARTIFICIAL GRAVITY IN ANIMALS
Ye. M. Yuganov and D. V. Afanas'yev *In its* Probl. of Space Biol. 29 Jun. 1964 p 190–197 refs (See N64-23734 16-16) OTS: $7.00

Data show that peculiarities of the function of the vestibular analyzer in weightlessness hamper the development and normalization of motor actions and lead to disturbances in the functional interaction in the system of analyzers. Labyrinthectomyzed animals seem to develop a new system of interaction between the rest analyzers, which is less subject to the removal of the most sensitive part, i.e., otolith apparatus. Author

N64-23751 Joint Publications Research Service, Washington, D.C.
MICROBIOLOGICAL AND CITOLOGICAL STUDIES IN THE CONQUEST OF SPACE
N. N. Zhukov-Verezhnikov, V. i. Yazdovskiy, I. N. Mayskiy, G. P. Tribulev, A. P. Pekhov et al *In its* Probl. of Space Biol. 29 Jun. 1964 p 198–205 refs (See N64-23734 16-16) OTS: $7.00

The results of a study of biological effectiveness of radiation on lysogenic bacteria are presented; the possiblity of using the lysogenic bacteria to select radiation protection measures is considered. The prospects of the development of space microbiology are discussed. Author

N64-23752 Joint Publications Research Service, Washington, D.C.
THE PROBLEM OF THE DEVELOPMENT OF A PHYSICO-CHEMICAL WASTE UTILIZATION COMPONENT FOR LONG-TERM SPACE FLIGHT
B. L. Gol'dshvend, B. G. Gusarov, A. G. Lobanov, Ye. Ye. Sinyak, A. P. Tereshchenko et al *In its* Probl. of Space Biol. 29 Jun. 1964 p 206–210 refs (See N64-23734 16-16) OTS: $7.00

The data of experimental investigations of reutilization of some body wastes by burning them or by employing chromatographic and catalytic methods are presented. Author

N64-23753 Joint Publications Research Service, Washington, D.C.
CHARACTERISTICS OF CERTAIN ARTIFICIAL SUBSTRATES FOR USE IN A CLOSED ECOLOGICAL SYSTEM
Ye. V. Lebedeva *In its* Probl. of Space Biol. 29 Jun. 1964 p 211–216 refs (See N64-23734 16-16) OTS: $7.00

The determination of the main physical constants that are typical of air and water properties of artificial substrates (vermiculite, penoshamote, ceramsite, perlite), as well as experiments with plants, have resulted in the composition of agrophysical characteristics of these substrates. Possibilities of usage of the substrates for higher plants in a closed ecological system have been indicated. Author

N64-23754 Joint Publications Research Service, Washington, D.C.
TOXIC GASEOUS SUBSTANCES GIVEN OFF BY CHLORELLA
M. M. Korotayev, V. V. Kustov, G. I. Meleshko, L. T. Poddubnaya, and Ye. Ya. Shepelev *In its* Probl. of Space Biol. 29 Jun. 1964 p 217–222 refs (See N64-23734 16-16) OTS: $7.00

During *Chlorella* cultivation the air of the system contains carbon monoxide, nitrogen oxides, and hydrocarbons (perhaps methane). The CO concentration ranged from 0.003 to 0.09 mg/1. The content of nitrogen oxides was 0.0006 to 0.012 mg/1 and that of hydrocarbons was 0.0033 to 0.061 mg/1. A possible mechanism for the production of these substances in photosynthesis is discussed. Author

N64-23755 Joint Publications Research Service, Washington, D.C.
GASEOUS ACTIVITY PRODUCTS EXCRETED BY MAN WHEN IN AN AIR-TIGHT CHAMBER
G. M. Gorban', I. I. Kondrat'yeva, and L. T. Poddubnaya *In its* Probl. of Space Biol. 29 Jun. 1964 p 223–230 refs (See N64-23734 16-16) OTS: $7.00

Experimental studies have shown that a human being in the process of his life activity liberates a number of toxic gaseous products into the surrounding medium. After man has stayed in

a sealed cabin for 24 hours the following amounts of the substances have been accumulated there: ammonium, 297 mg; Co for nonsmokers, 278 mg, and for smokers, 417 mg; hydrocarbons, 504 mg; aldehydes, 0.6 mg; ketons, 232 mg; mercaptanes and hydrogen sulphides, 5 mg; fatty acids 89 mg. Permanent constituents of the air in the cabin were carbon dioxide, hydrocarbons, aldehydes and ammonium, the first two being thereby found in the gaseous phase only while the others were contained both in the air and in the condensate. The data presented indicate the necessity to develop effective means of purifying air and to work out the grounds of admissible limits for the concentration of toxic substances in a sealed cabin. Author

N64-23756 Joint Publications Research Service, Washington, D.C.

THE PROBLEM OF ARTIFICIAL HIBERNATION IN SPACE BIOLOGY

N. N. Timofeyev, G. D. Glod, and V. S. Oganov *In its* Probl. of Space Biol. 29 Jun. 1964 p 231–240 refs (See N64-23734 16-16) OTS: $7.00

A comparative estimation of a number of methods of artificial hypothermy is presented in experiments on rats and dogs. A procedure of maintaining rats at – 18° to – 16° and dogs at – 25° to – 23° C in the state of deep hypothermy up to 24 hrs was elaborated, natural respiration and blood circulation being thereby retained. In experiments with rats a state of superdeep hypothermy was achieved employing the method of cooling under the conditions of hypoxy-hypercapnia. While in this state the animals underwent the action of accelerations incompatible with life (up to 74 units for 3 to 5 minutes), and main living functions of the organisms were then restored. The authors believe that the employment of artificial hibernation in space studies is quite possible, and they consider some ways of its practical application. Author

N64-23757 Joint Publications Research Service, Washington, D.C.

THE PROBLEM OF INVESTIGATION OF THE COSMONAUT'S PHYSICAL EFFICIENCY EXPERIMENTALLY AS APPLIED TO SPACE FLIGHT PROBLEMS

L. I. Kakurin, Yu. N. Tokarev *In its* Probl. of Space Biol. 29 Jun. 1964 p 241–250 refs (See N64-23734 16-16) OTS: $7.00

Man-in-space flights have proved that man is able not only to tolerate the action to extremal factors satisfactorily for a long time, but also is able to perform various tasks. The necessity to study the professional and research activity of the space crew has caused further integration of space physiology. The new science, the physiology of labor of space pilots, elucidates the capability of performing certain work at every stage of the flight and gives physiological grounds to the means for maintaining effective performance of the crew. By means of a simulating device whose conditions are maximally close to those of space flight, it seems possible to find out whether the stresses of a flight task are in agreement with the physical capacities of man and to establish the optimal regime of work and rest. Author

N64-23758 Joint Publications Research Service, Washington, D.C.

STUDY OF THE MOTOR REACTION TIME IN MAN BY THE MULTIPLE EFFECTOR METHOD UNDER ISOLATION CONDITIONS

V. I. Myasnikov *In its* Probl. of Space Biol. 29 Jun. 1964 p 251–264 refs (See N64-23734 16-16) OTS: $7.00

The physiological record of many indices during registration of a motor response under isolation conditions made it possible to separate the orienting reflex and to evaluate its role in the general response of the organism to the stimulus applied. The role of the orienting reflex changed according to the conditions of the experiment and functional state of the organism under test. In experiments with a regular diurnal cycle, the reduction of a latent period of the response was due to the degree to which the subjects were trained for this kind of reaction. In experiments with a shifted diurnal cycle but conducted in rarefied atmospheric pressure that corresponded to the height of 5,000 m, the orienting reflex represented the factor mobilizing the organism to respond to the action of its environment. This was reflected in a relative stability of indices of a latent period of a responsive motor reaction. Author

N64-23759 Joint Publications Research Service, Washington, D.C.

THE MAINTENANCE OF HABITS OF TRANSMITTING INFORMATION UNDER LONG-TERM ISOLATION CONDITIONS

A. P. Kuz'minov, V. F. Onishchenko, and M. M. Sil'vestrov *In its* Probl. of Space Biol. 29 Jun. 1964 p 265–270 refs (See N64-23734 16-16) OTS: $7.00

The influence of prolonged isolation on man's performance and on habit stability is discussed. The data of five experiments on prolonged confinement have been analyzed. In the first days the indices of the habit decrease qualitatively and quantitatively. During the second and third days of isolation the disturbed habit and performing ability are restored but not entirely. The averag errors for a well-trained operator are higher when he is working in isolation than when under normal circumstances. The character of emotional strain depends on the individual peculiarities of each subject studied. Author

N64-23760 Joint Publications Research Service, Washington, D.C.

THE EFFECT OF STATOKINETIC STIMULI ON CERTAIN BODY FUNCTIONS

G. V. Altukhov and V. I. Kopanev *In its* Probl. of Space Biol. 29 Jun. 1964 p271–291 refs (See N64-23734 16-16) OTS: $7.00

The effects of certain statokinetic stimuli on human beings, i.e., of quick head movements, slow rotations, and Coriolis accelerations, have been studied. Electrocardiogram, electroencephalogram, skin-galvanic reaction, blood pressure, and respiration rate were used as indices of the functional state. Subjective reports of those tested were also taken into account. The investigations carried out proved that upon the action of statokinetic stimuli the pulse rate and blood pressure increased, as a rule, while the intervals shortened and the amplitude of T and R spikes in ECG decreased. The cortical bioelectrical activity changed in a different manner (activation, or depression, or invariability were occasionally noted), which was to a certain degree due to statokinetic stability of the subjects. Author

N64-23761 Joint Publications Research Service, Washington, D.C.

COMBINED EFFECT OF VIBRATION AND IONIZING RADIATION ON THE VESTIBULAR AND MOTOR-DEFENSE REFLEXES

Z. I. Apanasenko and M. A. Kuznetsova *In its* Probl. of Space Biol. 29 Jun. 1964 p 292–302 refs (See N64-23734 16-16) OTS: $7.00

The effects of vibration on the radiation reaction on guinea pigs and black mice have been studied from the aspect of survival, function of the vestibular analyzer, and latent period of flexor reflex. Author

N64-23762 Joint Publications Research Service, Washington, D.C.

AUTONOMIC NERVOUS SYSTEM REACTIONS FROM STIMULATION OF THE VESTIBULAR ANALYZER AND THEIR POSSIBLE ROLE IN COMPLICATING SPACE FLIGHT CONDITIONS

A. V. Lebedinskiy, Yu. G. Grigor'yev, R. M. Lyubimova-Gerasimova, and B. I. Polyakov *In its* Probl. of Space Biol. 29 Jun. 1964 p 303–314 refs (See N64-23734 16-16) OTS: $7.00

Employing the method of gradual stimulation of semicircular canals, the role of the time factor in the action of a stimulus upon the manifestation of vestibulovegetative reflexes has been shown. A correlation between the value of an adequate stimulus and the character of these reflexes has been established. A hypothesis of biological expediency of some responses to the stimulation of the vestibular analyzer has been put forth, and mechanisms of their development are considered. Author

N64-23763 Joint Publications Research Service, Washington, D.C.

THE INFLUENCE OF GRAVITY EFFECTS FROM LANDING ON ANIMALS IMMERSED IN WATER

G. P. Mirolyubov *In its* Probl. of Space Biol. 29 Jun. 1964 p 315–323 refs (See N64-23734 16-16) OTS: $7.00

The enhancement of organism tolerance to the action of impact stresses has now become an urgent problem in space flights. The method of liquid immersion makes it possible to raise appreciably the tolerance limits of overloads occurring at the landing. The effect of hydraulic pressure at the moment of impact overloads can bring about changes in the functions of cardiovascular and respiratory systems and some disturbances in the organism that can be observed upon the action of an impact pressure wave. The protection of an organism against hydraulic pressure occurring at the impact moment makes it possible to withstand overloads up to 1,000 units quite satisfactorily. Author

N64-23764 Joint Publications Research Service, Washington, D.C.

THE EFFECT OF G-FORCES ACTING ONCE ON THE STRUCTURE OF THE INTERNAL ORGANS OF EXPERIMENTAL ANIMALS

V. G. Yeliseyev, Yu. N. Kopayev, and Ye. F. Kotovskiy *In its* Probl. of Space Biol. 29 Jun. 1964 p 324–333 refs (See N64-23734 16-16) OTS: $7.00

Overloads of 8 and 12 g acting in the ventrodorsal direction for 3 and 1 minute, respectively, bring about similar changes in internal organs of dogs. The changes are related to the vascular channel and to parenchymal elements. Most serious changes develop in organs of great mass and in the fine vascular system, i.e., lungs, liver, kidneys. The degree of change increases along the direction of stress action. Disturbances in the organs depend to a greater degree upon the duration of the stress action and to a lesser degree upon its value when overloads range within the limits mentioned (8 and 12 g). The changes observed are of reversible character. Their compensation takes place on the 30th to 60th day of the experiment. Author

N64-23765 Joint Publications Research Service, Washington, D.C.

STUDY OF THE BIOELECTRICAL ACTIVITY OF CERTAIN CEREBRAL CENTERS DURING GRAVITY EFFECTS

A. N. Razumeyev and P. M. Suvorov *In its* Probl. of Space Biol. 29 Jun. 1964 p 334–347 refs (See N64-23734 16-16) OTS: $7.00

Upon the action of transverse overloads, 17 subjects showed distinct changes in EEG of the brain cortex that were pressed in the synchronization of bioelectrical activity and were of phase character. The changes depended on the value and duration of the overload and of individual peculiarities of the subject under test. At the beginning, EEG showed quick β-waves; then α-rhythm began to prevail and was followed by Δ-waves. Author

N64-23766 Joint Publications Research Service, Washington, D.C.

THE EFFECT OF LONG-LASTING TRANSVERSE G-FORCES ON THE FUNCTIONAL CONDITION OF THE CENTRAL NERVOUS SYSTEM OF ANIMALS

V. Ye. Belay, P. V. Vasil'yev, and S. P. Kolchin *In its* Probl. of Space Biol. 29 Jun. 1964 p 348–355 refs (See N64-23734 16-16) OTS: $7.00

In experiments on white rats and mice the influence of transverse accelerations upon the functional interaction of excitatory and inhibitory processes in the brain cortex and subcortex was studied. The interactions were estimated on the basis of the animal responses to two kind of drugs: chloralhydrate and sodium thiopenthal. Upon long-term action of transverse accelerations, a change in the functional state of higher parts of the central nervous system is observed. The character of the change depends on the value and duration of the overload action. During short-term action (for 3 minutes) of overloads, excitation of brain cortex and inhibition of subcortex were noticed, whereas during extended action it proceeds in the other direction i.e., inhibition of cortex and excitation of subcortex. Author

N64-23767 Joint Publications Research Service, Washington, D.C.

THE SIGNIFICANCE OF PHYSIOLOGICAL STUDIES OF THE SPEECH PROCESS FOR PURPOSES OF CONSTRUCTING AUTOMATIC SPEECH RECOGNITION SYSTEMS

V. A. Kozhevnikov and L. A. Chistovich *In its* Probl. of Space Biol. 29 Jun. 1964 p 356–368 refs (See N64-23734 16-16) OTS: $7.00

Automatic distinction and synthesis of speech should be developed through a close physiological study of the main principles underlying the process of speech of man. The procedure of a continuous electrical registration of a number of indices characteristic of the articulation apparatus has been described. The procedure permits the study of the dynamics of articulation movements in speech and accumulates a statistically significant amount of relevant information. Author

N64-23768 Joint Publications Research Service, Washington, D.C.

CHARACTERISTICS OF A SUSPENSION OF ALGAE AS AN OPTICAL SYSTEM

S. V. Tageyeva, A. B. Brandt, V. S. Korshunova, and I. P. Generozova *In its* Probl. of Space Biol. 29 Jun. 1964 p 369–390 refs (See N64-23734 16-16) OTS: $7.00

With the aid of a universal device for the investigation of plant optical properties those of the suspension of Chlorella pyrenoidosa P-82 and Chlorella sp. K strains were studied. Light absorption by the Chlorella suspension of one strain proceeds in agreement with the Bouguer–Lambert–Beer law, the absorption value being in the main determined by the concentration of pigments (chlorophyll) in the volume studied. Nevertheless, the absolute value for various strains of Chlorella strongly depends upon the cell dimensions and microscopic structures. Optical parameters of algal strains applied can provide information on the nature of their photosynthetic apparatus and be used for calculations of special device to obtain cultures of unicellular alga of high productivity. Author

N64-23769 Joint Publications Research Service, Washington, D.C.

CHANGE IN THE SENSITIVITY AND REACTIVITY OF THE VESTIBULAR ANALYZER UNDER THE INFLUENCE OF IONIZING RADIATION

A. A. Sveshnikov and A. V. Sevan'kayev *In its* Probl. of Space Biol. 29 Jun. 1964 p 391–403 refs (See N64-23734 16-16) OTS: $7.00

Taking into account the urgency of the problem of ionizing radiation effect on the function of the vestibular analyzer, a study to determine a dose to bring about first functional changes was undertaken. The changes in the vestibular analyzer upon γ-irradiation of rabbits and dogs of 50 to 5,000 r were observed. A group of dogs was irradiated with protons of 500 to 350 rad (proton energy 510 Mev). The threshold sensitivity and reactivity were determined by means of a rotating device, and cupulograms, termed vestibulograms, were plotted. First changes in the function of labyrinth have been found to take place at the dose of 50 and 100 r. The dose of 200 r can be considered as a threshold because a regular decrease in the labyrinth excitability is observed; higher doses lead to a considerable inhibition of the function of the vestibular apparatus. The doses of 100 and 50 r can be expected to display an opposite effect, i.e. augmented excitability of the analyzer. The data are presented, concerning a conjugated increase in excitability as a result of a cumulative action of irradiation, vibration, reduced atmospheric pressure, and noise upon a living organism. Author

N64-23770 Joint Publications Research Service, Washington, D.C.

REACTIONS OF THE VASCULAR SYSTEM OF THE CRANIAL CAVITY DURING EQUIVALENT LONGITUDINAL G-LOADS OF ± g

Yu. Ye. Moskalenko, O. V. Graunov, O. G. Gazenko, and N. I. Kas'yan *In its* Probl. of Space Biol. 29 Jun. 1964 p 404–415 refs (See N64-23734 16-16) OTS: $7.00

In experiments on rats, rabbits, and cats the electroplethysmography technique has been applied to study changes in blood filling of intracranial cavity upon equivalent longitudinal gravitation loads ± g appearing when the animal is in vertical position. While comparing the curves obtained with calculations made on simulation models, active responses of the brain vascular system have been revealed that occur 4 to 8 seconds after the body posture has changed and are meant to normalize the bloodfilling of the intracranial cavity. In some cases electroplethysmography indicated disturbances in the activity of the central nervous system. Some special experiments have shown that active reactions are specific for cerebral vessels, and they appear upon equivalent longitudinal gravitation loads of 0.3 ±0.4 g. Author

N64-23771 Joint Publications Research Service, Washington, D.C.

THE APPLICATION OF MATHEMATICAL METHODS TO SPACE MEDICINE

R. M. Bayevskiy, V. V. Bogdanov, A. D. Voskresenskiy, A. D. Yegorov, and N. A. Chekhonadskiy *In its* Probl. of Space Biol. 29 Jun. 1964 p 419–430 refs (See N64-23734 16-16) OTS: $7.00

Effective employment of telemetric channels is connected with the application of the theory of information and with the calculation of elements in onboard computers. The opportunity is given for obtaining additional information by calculating the correlative function. Some examples of algorithms for automatic information processing are given. Biological implications of certain mathematical indices decoding medical information are presented. The application of simulation models is considered. Author

N64-23772 Joint Publications Research Service, Washington, D.C.

SOME PROBLEMS OF APPLICATION OF THE THEORY OF RANDOM FUNCTIONS TO SPACE BIOLOGY AND MEDICINE

A. D. Yegorov and N. A. Chekhonadskiy *In its* Probl. of Space Biol. 29 Jun. 1964 p 431–437 refs (See N64-23734 16-16) OTS: $7.00

It has been ascertained that the main physiological functions of an animal (dog) and man represent mathematically random functions of time or external effects upon the organism. The question of mathematical processing of the results of physiological investigations employing methods developed by the theory of random functions is considered. Physiological interpretation of statistical characteristics of random functions is presented. Author

N64-23773 Joint Publications Research Service, Washington, D.C.

METHODS OF OBTAINING OXYGEN BY ELECTROLYTIC DECOMPOSITION OF WATER UNDER CONDITIONS OF WEIGHTLESSNESS

B. G. Grishayenkov, L. L. Zablotskiy, O. F. Ostapenko, Yu. M. Semenov, and A. G. Fomin *In its* Probl. of Space Biol. 29 Jun. 1964 p 438–442 refs (See N64-23734 16-16) OTS: $7.00

To perform electrolysis under conditions of weightlessness, it is necessary to provide the removal of the gases formed (oxygen and hydrogen) and a continuous contact of electrodes with the main mass of electrolyte. This can be done either with the aid of an artificial field of force by means of rotation of the device as a whole (or some parts of it), or at the expense of the physical and chemical properties of substances composing electrodes and diaphragms. Author

N64-23774 Joint Publications Research Service, Washington, D.C.

THE POSSIBILITY OF PHYSICOCHEMICAL SYNTHESIS OF CARBOHYDRATES IN A SPACESHIP CABIN

Yu. Ye. Sinyan *In its* Probl. of Space Biol. 29 Jun. 1964 p 443–453 refs (See N64-23734 16-16) OTS: $7.00

Under the conditions of a prolonged space flight, carbon dioxide, hydrogen, and water are initial products for the synthesis of carbohydrates. Experiments on the reaction with the use of a smouldering discharge and ultraviolet reaction were unsuccessful. The way to synthesize carbohydrates is

the employment of the reaction of formaldehyde polymerization discovered by Butlerov. One possible scheme of carbohydrate synthesis under space flight circumstances involves hydration of CO_2 to methane, oxidation of methane to formaldehyde, with subsequent polymerization to monosaccharides. Formaldehyde can be obtained via methanol formation. Author

N64-23775 Joint Publications Research Service, Washington, D.C.
THE PROBLEM OF INCREASE IN THE PHOTOSYNTHETIC PRODUCTIVITY OF A CHLORELLA CULTURE IN APPARATUSES FOR BIOLOGICAL REGENERATION OF AIR
G. I. Meleshko *In its* Probl. of Space Biol 29 Jun. 1964 p 454–458 refs (See N64-23734 16-16) OTS: $7.00

The productivity of *Chlorella* cultures in great densities has been investigated. It has been shown that it is possible to obtain about 246 e oxygen per e suspension per day at the expense of a considerable increase of the culture density, the cultivation conditions being retained for each cell. Author

N64-23776 Joint Publications Research Services, Washington, D.C.
ANALYSIS OF TWO METHODS FOR MEASURING THE RATE OF PHOTOSYNTHESIS OF CHLORELLA
Ye. A. Ivanov and I. V. Aleksandrov *In its* Probl. of Space Biol. 29 Jun. 1964 p 459–475 refs (See N64-23734 16-16) OTS: $7.00

While studying the dynamic properties of *Chlorella* culture, the capillary manometric and the polarographic methods to measure the photosynthesis intensity of this culture have been investigated. It has been established that, upon certain parameters and techniques, an apparatus of high precision and insignificant delay can be designed. The polarographic method is more adequate for the development of a photosynthesis indicator in the systems of automatic operation than biological regeneration of the air. Author

N64-23777 Joint Publications Research Service, Washington, D.C.
REPEATED USE OF NUTRIENT MEDIA FOR THE CULTIVATION OF CHLORELLA PYRENOIDOSA
T. B. Galinina *In its* Probl. of Space Biol 29 Jun. 1964 p 476–480 refs (See N64-23734 16-16) OTS: $7.00

The influence of a repeated use of cultural liquids on *Chlorella* growth has been investigated. Their stimulatory and inhibitory action is related to an absolute increase in the amount of cells per volume of medium unit during the period of preliminary cultivation. When growing a cultural liquid utilized for the second time its effect of stimulation or inhibition decreases. Author

N64-23778 Joint Publications Research Service, Washington, D.C.
MATHEMATICAL ANALYSIS OF THE PROCESS OF MASS CULTIVATION OF CHLORELLA IN BIOLOGICAL CULTIVATORS WITH IRREGULAR SHAPES
I. V. Smirnov *In its* Probl. of Space Biol. 29 Jun. 1964 p 481–502 ref (See N64-23734 16-16) OTS: $7.00

Productivity of biological cultivators of asymmetric profile is estimated quantitatively. The relation of the irradiated surface to the suspension volume required to provide an adequate gas-exchange for a given rayflux intensity is presented. The values of coefficients characterizing a biological cultivator as a gas-exchanger are given. Author

N64-23779 Joint Publications Research Service, Washington, D.C.
THE PROBLEM OF AUTOMATIC CONTROL OF ALGAL CULTIVATION CONDITIONS
Ye. A. Ivanov and I. V. Aleksandrov *In its* Probl. of Space Biol. 29 Jun. 1964 p 503–516 refs (See N64-23734 16-16) OTS: $7.00

An analytical study of a kind of extremal operation over Chlorella utilized as a green plant in the system of biological air regeneration is presented. It has resulted in well-grounded suggestions concerning biological and engineering investigations of the culture required for its automatic operation. Author

N64-23780 Joint Publications Research Service, Washington, D.C.
THE PROBLEM OF BURNING ACTIVITY WASTE OF ORGANISMS (GAS FRONT REACTIONS, THE CONDITIONS OF THEIR EXISTENCE AND PROPAGATION)
S. N. Shorin and V. M. Dapshis *In its* Probl. of Space Biol. 29 Jun. 1964 p 517–533 refs (See N64-23734 16-16) OTS: $7.00

The paper describes some peculiarities typical of front gas reactions in combustible gas mixtures that take place in limited or unlimited space, regardless of the effects of gravitational fields. A formula is given to determine the lowest limit of reactivity; by means of mathematical analysis an equation to estimate the distribution rate of the reaction front is obtained. Calculations by formulas are compared to various experimental data. Author

N64-23781 Joint Publications Research Service, Washington, D.C.
AUTOMATION OF CULTIVATION OF UNICELLULAR ORGANISMS FOR UTILIZATION IN A CLOSED BIOLOGICAL SYSTEM
I. N. Gitel'zon, N. A. Terskov, V. A. Batov, O. G. Baklanov, and B. G. Kovrov *In its* Probl. of Space Biol. 29 Jun. 1964 p 534–539 (See N64-23734 16-16) OTS: $7.00

A simulation model was used to try automatic operation in many parameters over biosynthesis of unicellular organisms. An emphasis is placed on those studies of transition processes in the culture growth as the parameters of the external medium change. Author

N64-23782 Joint Publications Research Service, Washington, D.C.
AUTOMATED APPARATUS FOR STUDYING THE RELATIONSHIP BETWEEN THE PHOTOSYNTHESIS OF HIGHER PLANTS AND MINERAL NUTRITION
V. G. Chuchkin and V. I. Rozhdestvenskiy *In its* Probl. of Space Biol. 29 Jun. 1964 p 540–551 refs (See N64-23734 16-16) OTS: $7.00

The concentration of elements in the nutritive solution can be regulated according to any given program by means of panels of industrial automatic devices. Photosynthesis is measured by infrared gas analyzer. Author

N64-23865 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MEASUREMENT OF THE TOTAL RADIATION DOSE ON VOSTOK 5 AND 6

I. A. Savenko, N. F. Pisarenko, P. I. Shavrin, and V. Ye. Nesterov *In its* Cosmic Res. 27 Apr. 1964 p 236–239 refs (See N64-23852 16-29)

This article describes the results obtained from the data of the dosimetric apparatus on Vostok V and VI. The total radiation doses received by cosmonauts V. F. Bykovsky and V. V. Tereshkova are submitted. Author

N64-23867 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

FLUCTUATIONS IN THE ELECTROENCEPHALOGRAM OF A MAN

V. I. Myasnikov *In its* Cosmic Res. 27 Apr. 1964 p 248–259 refs (See N64-23852 16-24)

This article cites the dynamics of the basic EEG indices (alpha-rhythm frequencies) and amplitudes and also the response when a light stimulus is cut off during extended isolation under different regimes of daily activity. In the tests with a normal regime, the alpha-rhythm amplitude of the initial EEG curve dropped without changing its frequency, while in those with a shifted regime the decrease of the alpha-rhythm amplitude was accompanied by the appearance of diffuse slow waves and alpha-rhythm exaltation as a result of the stimulus. These fluctuations of biological activity give grounds for hypothesizing the development of inhibitory processes in the central nervous system of the subjects. Author

N64-23896 Army Medical Research and Nutrition Lab., Denver, Colo.

THE EXCRETION OF LIPID AND LIPID SUBSTANCES IN HUMAN SWEAT

C. Frank Consolazio, Le Roy O. Matoush, Richard A. Nelson, and Gilbert A. Leveille 13 Nov. 1963 9 p refs
(Rept.-280; AD-433521)

Under the conditions of this study at high environmental temperatures, the total excretion of lipid substances in sweat was low and would not seem to be of consequence in studies of lipid metabolism. During a 7 1/2-hour exposure period at high temperatures, the total lipid excretion in sweat ranged between 25 and 46 mg. As one would expect, since the total lipid excretion in sweat was low, the excretion of cholesterol, free and total, and lipid phosphorus were also low. Author

N64-23899 Grumman Aircraft Engineering Corp., Bethpage, N.Y.

A METHOD FOR THE PRODUCTION OF CONTROLLED MICROBIOLOGICAL CORROSION ON TEST SPECIMENS

Edward A. Calvelli 1 Oct. 1963 11 p refs
(ADN-09-08a-63.1)

An accelerated biological method was developed to produce corrosion on various test alloys. This method will provide corroded specimens almost as rapidly as any artificial means, and being biologically induced, it will produce more natural configurations. Two organisms are used to produce the desired corrosion; Thiobacillus thioparus and Thiobacillus thiooxidans. These organisms are strict autotrophs (able to grow in the absence of organic matter) and therefore make the media easier to prepare and maintain. They were selected for their ability to produce sulfuric acid as a waste product and to tolerate a considerable amount of it in the media employed. Sterility is not required, and safety problems are minimized. Author

N64-24007 Argentina Comision Nacional De Energia Atomica, Buenos Aires

LOCALISATION OF THE PLACENTA BY MEANS OF RADIOACTIVE ISOTOPES [LOCALIZACION DE LA PLACENTA POR MEDIO DE LOS ISOTOPOS RADIOACTIVOS]

Leon Fisch, Hernan Garcia Del Rio, and Victorio Pecorini 1963 12 p refs In SPANISH *Its* Informe No. 97

A new clinical method for determining the site of the insertion of the female placenta has been tested clinically. Using 1 1/2 grains of radioactive potassium, X-ray analysis, and albumin counts, the method is 90% effective. However, the clinical evidence is still insufficient for general adaptation of the method. D.E.R.

N64-24008* Maryland U., College Park

BUFFERING ACTIVITY OF ALGAL CELLS AND ITS EFFECT ON CELL DIVISION

Constantine Sorokin New York and London, Academic Press [1964] 9 p refs Repr. from Exptl. Cell Research no. 33, 1964 p 508–515
(Grant NsG-70-60)

Buffering capacity of cells was evaluated in terms of its effects on changes in pH of the suspending fluid and on cell division. Synchronized 7-hour cells of the green, high-temperature alga, *Chlorella* 7-11-05, were centrifuged out of a complete nutrient medium, resuspended in different concentrations of sulfuric acid, and supplied in darkness with atmospheric air. It was observed that the effect of buffering activity of cells on pH of the surrounding medium was a gradual, time-dependent phenomenon. Changes in pH and the degree of the completion of cell division depended on the initial acidity of the medium and on the amount of cells per volume of suspension. With the increase in acidity, the amount of cells required to buffer it increased disproportionally faster. Thus, within certain range of acid concentrations, a doubling in acidity required 2.2 times increase in the amount of cells necessary to buffer the new level of acidity. Factors affecting buffering activity of cells were discussed. Author

N64-24012 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE STATE OF WEIGHTLESSNESS AND ARTIFICIAL GRAVITY

I. I. Kas'yan and V. I. Kopanev 20 Mar. 1964 26 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. No. 6, 1963 p 880–891
(FTD-TT-64-140/1+4; AD-435526)

Space medicine is currently confronted with important problems relating to the prevention of undesirable influences on animals and man due to weightlessness. The greatest prospects lie in the creation of artificial gravity, so that persons can be provided with earth-like conditions aboard the spacecraft during extended flights. G.D.B.

N64-24070 Federation of American Societies for Experimental Biology, Washington, D.C. Life Sciences Research Office

A STUDY OF THE RATIONALE AND TECHNIQUES FOR LONG-RANGE TECHNOLOGICAL FORECASTING IN THE BIOLOGICAL AND MEDICAL SCIENCES

15 Mar. 1964 52 p refs
(Contract DA-49-092-ARO-9)
(AD-436723)

Forecasts are potential aids in the planning of future technological environments. Their usefulness depends on their validity. Accurate deductions are essential regarding anticipated responsiveness to existing and expected opportunities

for achievements in selected areas of science and technology. This is a review of the multiple forces that determine the reliability of such deductions or predictions. Author

N64-24100 Library of Congress, Washington, D.C. Aerospace Information Div.
SOVIET LITERATURE ON LIFE SUPPORT SYSTEMS. PART A: BIOSCIENCES Compilation of Abstracts
6 May 1964 19 p refs
(AID-P-64-33; AD-600129) OTS: $1.60 ph

This is a compilation of abstracts on space medicine and biology, space physiology, and perceptual physiology. E.C.

N64-24110* Chicago U., Ill. Enrico Fermi Inst. for Nuclear Studies
NEW APPROACHES IN CORRELATIVE STUDIES OF BIOLOGICAL ULTRASTRUCTURE BY HIGH-RESOLUTION ELECTRON MICROSCOPY
H. Fernandez-Moran [1963] 34 p refs Presented at the Roy. Microscop. Society's Celebration of the "Tercentenary of the Microscope in Living Biology", Bethesda, Md., 9 Apr. 1963 Submitted for Publication
(Grants NsG-441-63; NIH-B-2460; NIH-C-3174; NIH-NB-04267; Contract AT(30-1)-2278)
(NASA-CR-56227) OTS: $3.60 ph

In this brief review, representative examples have been selected to illustrate characteristic features of new methodological approaches in correlative studies of native biological systems. The topics covered are as follows: (1) fine structure of the nerve myelin sheath; (2) electron microscope and X-ray diffraction studies of crystalline insect virus inclusions; (3) correlation of ultrastructure and function in mitochondrial membrane; (4) electron microscopy of negatively stained solubilized lipids; (5) correlated electron microscopic and biochemical studies of the *E. coli* pyruvate dehydrogenation complex; (6) the study of biological systems at liquid-helium temperatures; and (7) general design concepts of a cryoelectron microscope using superconducting electromagnetic lenses. R.T.K.

N64-24116* Allied Research Associates, Inc., Concord, Mass.
BIBLIOGRAPHY ON BIOSENSORS. A SAMPLING OF THE WORLD LITERATURE 1900–1963
J. Healer Dec. 1963 340 p refs 3rd Ed.
(Contract NASw-535)
(NASA-CR-56347; ARA-T-9211-5 Vol. II) OTS: $19.75 ph

This bibliography was compiled during a program for assembly, evaluation, analysis, and application of biosensing devices. It was placed in an IBM-card code system, and the cards are available. A.W

N64-24141 School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
DETERMINATION OF THE SOLUBILITY OF NEON IN WATER AND EXTRACTED HUMAN FAT
Kenneth G. Ikels May 1964 8 p refs
(SAM-TDR-64-28; AD-601602)

A gas chromatographic technique in conjunction with a modified Van Slyke apparatus is described for the determination of the Bunsen absorption coefficient (α) for neon in water, olive oil, and extracted human fat. Essentially, the method consists of a double extraction of sample material that was equilibrated at a stated temperature with neon. The gas liberated from the sample is then quantified by gas chromatography. The observed Bunsen absorption coefficient (α) for neon in water agrees closely with the value reported in literature. The present method may be regarded as sufficiently accurate for the determination of neon solubility in biologic fluids, fats, and oils. Present results of the solubility of neon in extracted human fat confirm a prediction that the biologic properties of neon should lie between nitrogen and helium, coming somewhat closer to the latter. The observed Bunsen absorption coefficients supply new information on the solubility of neon in human fatty material, olive oil, and water. Author

N64-24185 Naval Radiological Defense Lab., San Francisco, Calif.
PRIMER ACTIVITY OF THYMUS DNA FRACTIONATED BY ECTEOLA COLUMN CHROMATOGRAPHY
W. D. Skidmore, R. K. Main, and L. J. Cole 12 Jun. 1963 22 p refs
(USNRDL-TR-655; AD-414704)

The DNA-primer activity of Ecteola fractionated calf- and rat-thymus DNA samples was determined by a DNA-polymerase assay system. All DNA samples assayed, heated or unheated, and fractionated or unfractionated, showed some degree of DNA-primer activity. The chromatographic profiles of heated DNA were different from those of unheated DNA. Phenol and p-aminosalicylate, used in the preparation of DNA, did not alter the patterns of DNA obtained by Ecteola chromatography. Sephadex chromatography was found to be a rapid and effective method to deionize DNA solutions. DNA-primer activity was increased by an ammonium hydroxide gradient. At 4°, treatment of DNA by phenol and p-aminosalicylate, Ecteola column chromatography with a salt gradient, Sephadex column chromatography with deionized distilled water to desalt DNA, and lyophilization did not alter DNA-primer activity. The results indicate that DNA-primer activity, per se, is not specifically associated with one particular fraction of DNA. Author

17 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and materials fabrication, handling and inspection. *For related information see*: 06 Auxiliary Systems.

N64-22736 Joint Publications Research Service, Washington, D.C.
MATERIALS, TECHNOLOGY AND PRODUCTION ECONOMY WELDING OF AUSTENITIC HEAT RESISTING STEELS AND ALLOYS USED IN BUILDING GAS TURBINES
B. I. Medovar 16 Jun. 1964 17 p Transl. into ENGLISH from Energomashinostroyeniye, (Leningrad), no. 3, 1964 p 25–30
(JPRS-25100; OTS-64-31492) OTS: $0.50

This article discusses: (1) the improvement of the weldability of austenitic steel and alloys by electroslag remelting; (2) welding under flux and electroslag welding of heat-resistant steels and alloys with a high nickel content; and (3) electronic-beam and diffusion welding of heat-resistant steels and alloys. I.v.L

N64-22741 Joint Publications Research Service, Washington, D.C.
NEW TECHNOLOGY IN INVESTMENT CASTING

A. S. Lakeyev 19 Jun. 1964 8 p Transl. into ENGLISH from Mashinostr. (Kiev), no. 6, Nov.–Dec. 1963 p 37–40
(JPRS-25172; OTS-64-31524) OTS: $0.50

New technology of investment casting is reviewed, and emphasis is placed upon the following: (1) the preparation and use of rubber press-molds; (2) the preparation and use of press-molds made from liquid glass mixtures; (3) pattern compositions; (4) the preparation of urea and of cesium cores; and (5) methods of removing the pattern mixture from the casting. I.v.L.

N64-22916 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
INVESTIGATIONS OF FLANGES AND GASKETS
E. F. Boon and H. H. Lok 5 May 1964 49 p refs Transl. into ENGLISH from Z. Des Vereins Deutscher Ingenieure, v. 100, no. 34, 1958 p 1613–1624
(RSIC-171; AD-440805)

From a combination of results of tests conducted on model and full-size flanges, simple, nondimensional formulas are derived for the design of high, narrow flanges for vessels and conduits. Loads and flange distortion (radial rotation) are mathematically interrelated. The model tests make possible additional determination of the behavior of the flange under pressure and temperature fluctuations. It has been found that for high pressures, the self-sealing gasket is most suitable. High-pressure gaskets are not completely gastight at all temperatures. Soft, flat, metal gaskets are best suited for the severe requirements of nuclear powerplants. N.E.A.

N64-23074 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE PROBLEM OF DETERMINING THE TECHNOLOGICAL PARAMETERS IN THE BENDING AND STRETCHING OF PROFILE PARTS
A. F. Akhmerov and I. F. Parkhomenko (Kazan Inst. of Aviation) *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 113–120 refs (See N64-23066 16-03)

Solutions to the problems of determining the technological parameters of bending and stretching processes are derived in this paper. Analytic relations are derived for profiles with two axes of symmetry bent in one of the planes of symmetry. The parameters of the bending processes are considered for complex profiles whose cross sections consist of rectangular shapes that are unsymmetrical about the bending axis. A procedure is then given for determining the accuracy of the bending process. D.E.R.

N64-23075 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINATION OF PLACEMENT ERRORS OF SURFACE IN MACHINING COMPONENTS
A. S. Shevelev and G. P. Fedorchenko (Kuybyshev Aviation Inst.) *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 121–135 refs (See N64-23066 16-03)

A method for determining the errors in mutual positioning of surfaces during machining operations is derived. The errors—displacement of the axes, deviation from the perpendicular, etc.—encountered in mutual location of surfaces depend on a number of factors, such as the following: (1) positioning errors of the machine bases; (2) errors in setting up the component and the tool; (3) warping of the component; and (4) errors in positioning the surfaces of the blanks, etc. The results make it possible to sum errors by taking into account the production hazard percentage, and also to determine the precision of positioning operations and the nonuniformity of the allowance to be removed. D.E.R.

N64-23080 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AUTOMATION
14 Feb. 1963 124 p refs Transl. into ENGLISH from Automatika, Akad. Nauk Ukr. RSR (Kiev), no. 2, 1962 p 1–89
(FTD-TT-62-1521/1+2)

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N64-23092 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
USING NEGATIVE STATIC CHARACTERISTICS OF A SOURCE-ARC SYSTEM FOR WELDING WITH NONCONSUMABLE ELECTRODE
Ye. M. Yesibyan *In its* Automation 14 Feb. 1963 p 103–108 refs (See N64-23080 16-17)

A way of stabilizing the melting effect of a welding arc by obtaining a direct dependence of current upon arc length is proposed. Investigations have shown that, at a certain negative deviation of the characteristic I = f(L), the current deviations and the arc-length deviations are mutually compensated so that the melting effect of the arc and the welding condition remain virtually unchanged. This method has been used for faultlessly welding thin sections of steel in an argon medium. M.P.G.

N64-23202 Mechanical Technology, Inc., Latham, N.Y.
THE STATIC AND DYNAMIC CHARACTERISTICS OF THE SPIRAL-GROOVED THRUST BEARING
S. B. Malanoski and C. H. T. Pan 15 Mar. 1964 38 p refs
(Contract Nonr-3730(00))
(MTI-23(1-63; MTI-64TR11; AD-436262)

A generalized analysis for spiral-grooved thrust bearings is presented. The effects of local radius are considered. For the same inside-to-outside radius ratio, the inflow design is superior in the load capacity. The analysis also treats a relative, transverse, oscillatory motion of the bearing surfaces. Both the magnitude and phase angle (in the temporal sense) of the bearing reaction are dependent on the frequency of the motion. The results for the oscillating motion reveal the possibility of a self-excited, rotor-bearing instability. The criterion for determining the onset of this type of instability is given. Author

N64-23364 Mechanical Technology, Inc., Latham, N.Y.
CHARACTERISTICS OF HERRINGBONE-GROOVED, GAS-LUBRICATED JOURNAL BEARINGS
John H. Vohr and C. Y. Chow 2 Apr. 1964 43 p refs
(Contract Nonr-3730(00))
(MTI-64TR15; AD-436263)

A differential equation is obtained for the "smoothed" overall pressure distribution around a herringbone-grooved, gas-lubricated, journal bearing operating with a variable film thickness. The equation is based on the limiting case of an idealized bearing for which the number of grooves approaches an infinite number. A numerical solution to the differential equation is obtained that is valid for small eccentricities. This solution includes the case where the journal is undergoing steady circular whirl. Author

N64-23443 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF INORGANIC SALTS FOR THE PURPOSE OF USING THEM AS HIGH-TEMPERATURE LUBRICANTS
M. M. Fialko and A. I. Dintses 7 Jan. 1964 10 p refs Transl. into ENGLISH from Khim. i Tekhnol. Topliv i Masel (Moscow), no. 10, 1963 p 22–26
(FTD-TT-63-1152/1+2; AD-430146)

An evaluation of antiwear and corrosion properties was the main object testing. The antiwear test was performed on a four-ball apparatus; the balls were made of silicon–molybdenum steel and had a 12.7-mm diam. The corrosion test was performed in a quartz test tube placed in a thermostat. The salt was placed in the test tube, and after its fusion the plates of the metal to be tested were inserted. Purified air was then blown through the fusion product. The corrosion was determined by the change in the weight of the plates. A.L.B.

N64-23495 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STUDY OF THE OPERATION OF A CENTRIFUGAL COMPRESSOR WHEEL
S. A. Anisimov *In its* Power Machine Construct., 4 Mar. 1963 p 1–19 refs (See N64-23494 16-01)

An investigation was carried out to study the operation efficiency of a centrifugal compressor wheel and to quantitatively associate individual experimental data with the results of theoretical analysis. P.V.E.

N64-23496 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE INFLUENCE OF THE NUMBER OF VANES ON THE EFFICIENCY OF THE CENTRIFUGAL WHEEL WITH A SINGLE-STAGE CASCADE
S. A. Anisimov, F. S. Rekstin, and K. P. Seleznev *In its* Power Machine Construct., 4 Mar. 1963 p 20–43 refs (See N64-23494 16-01)

The results of an experimental study of the influence of the number of vanes on a centrifugal wheel on its characteristics and on the flow structure behind the wheel are analyzed. It is concluded that the analysis of the obtained data makes it possible, in many cases, to give a qualitative (and in some cases quantitative) estimate of the influence of the number of vanes on other designs and gas-dynamic parameters of the wheel and flow structure. P.V.E.

N64-23497 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STUDY OF THE EFFICIENCY OF CENTRIFUGAL COMPRESSOR WHEELS WITH A TWO-STAGE VANE CASCADE
S. A. Anisimov et al *In its* Power Machine Construct. 4 Mar. 1963 p 44–68 refs (See N64-23494 16-01)

A theoretical and experimental study of the influence of (1) the number of vanes and (2) the intake diameter on the operational efficiency of centrifugal compressor wheels with simple two-stage cascade is discussed. A comparison of the theoretical and experimental results is presented. P.V.E.

N64-23566 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE INFLUENCE OF CLEARANCES IN BEARINGS AND OF THE ECCENTRICITY OF MASSES UPON THE VIBRATIONS OF ROTORS
M. F. Khromeyenkov *In its* Mech. 28 Aug. 1963 p 246–278 refs (See N64-23551 16-01)

The influence of clearances in bearings and the initial eccentricity of masses on the critical velocity of a rotor is computed when the journals are in a position such that their centers describe circles having radii P_A and P_B. In cases where P_A and P_B can be considered constant, the critical velocities are determined taking into consideration the centrifugal forces due to the translational motion of the journals in their bearings, the character of the dynamic loading of the shaft is established, and the bending moment and corresponding deflection are computed. The methodology developed can also be applied to problems of clearances and distribution of masses in gyroscopic instruments. M.P.G.

N64-23912* Georgia Inst. of Tech., Atlanta
PIGMENT PARTICLE SIZE SEPARATION
William J. Corbett and Clyde Orr, Jr. Washington, NASA, Jul. 1964 48 p refs
(Contract NAS8-848)
(NASA-CR-78) OTS: $1.25

Research was carried out on classification of titania pigment into a number of size fractions in the diameter range of from 0.20μ to 2.5μ and to produce these fractions in experimental quantities of approximately 100 g. A batch-type centrifuge was developed specifically to accomplish the particle size classifications. Its main feature was a cell having a tapered body leading to a special sediment collector. The collector was constructed in several demountable sections so that sedimented titania could be divided into portions by simply isolating the sections. More than 50 g of six different particle-size

fractions have been produced having 95% of their particles under 2.8μ, 2.5μ, 2.4μ, 1.6μ, 1.1μ, and 0.7μ in diameter, respectively, from a wide-size range (0.1μ and 0μ to above 4.0μ particle diameter) of titanium dioxide. P.V.E.

N64-24109* Brown Engineering Co., Inc., Huntsville, Ala. Systems Evaluation and Test Div.
PRESSURE DROP IN FLEXIBLE METAL HOSES, BELLOWS, AND GIMBAL JOINTS An Annotated Bibliography
J. G. Belcher, Jr. 15 May 1964 9 p refs
(Contract NAS8-11166)
(NASA-CR-56540; ER-1174)

The following are included in this bibliography: (1) the effect of the character of surface roughness on velocity distribution and boundary resistance; (2) flexible components for pneumatic ducting system; (3) design and testing of large gas ducts; (4) pressure losses in flexible metal tubing; (5) designing for duct flexibility with bellows joints; (6) determining pressure drop in a flexible metal hose; (7) pressure-loss factors for internally linked bellows joints; (8) bellows design for aerospace vehicles; (9) friction factors of straight and curved flexible metal hoses as a function of Reynolds number; (10) friction factors for flow through corrugated hose and bellows; (11) airflow equations; (12) pressure losses in a hoseline; (13) friction factors in corrugated metal pipe; (14) pressure losses in a flexible metal hose utilized in propulsion fluid systems; (15) flow tests with bellows expansion joints; and (16) effect of wire wraps on the pressure drop for axial turbulent flow through rod bundles. R.T.K.

N64-24125* Battelle Memorial Inst., Columbus, Ohio
SPACE-VEHICLE STABILIZED-PLATFORM GIMBAL-SYSTEM WEIGHT-REDUCTION STUDY. PHASE V. GIMBAL-SEAL CARTRIDGE DESIGN Summary Report
J. W. Adam, T. J. Atterbury, and T. M. Trainer 31 Mar. 1964 43 p refs
(Contract NAS8-5101)
(NASA-CR-56645) OTS: $4.60 ph

This report describes the investigation of candidate seal materials and experiments on single- and double-seal characteristics. The work showed that the torque and leakage of present gimbal configurations can be significantly reduced if a bellows-actuated, Teflon face seal is used. The mating-seal materials should be virgin Teflon finished by the cold-press procedure, and a concentrically ground metal surface. The Teflon seal should be approximately 1/8-inch wide and of overbalanced design. Author

N64-24208 McDonnell Aircraft Corp., St. Louis, Mo.
EFFECT OF SALT SPRAY EXPOSURE ON A-286 FASTENERS
10 Jun. 1964
(Contract AF 33(657)-112-5)
(A734; AD-441112)

This report is concerned with the determination of the effect of salt-spray exposure on A-286 fasteners. Results of tests indicate that non-heat-scaled specimens resist corrosion from salt spray exposure better than the heat-scaled specimens. I.v.L.

18 MATERIALS, METALLIC

Includes cermets; mechanical and physical properties of alloys and metals; and metallurgy. *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 19 Materials, Nonmetallic; 33 Stresses and Loads; and 34 Structural Design.

N64-22733 Joint Publications Research Service, Washington, D.C.
AGE-HARDENING CHARACTERISTICS OF NICKEL-BASE HEAT-RESISTING ALLOYS
Taro Hasegawa 9 Jun. 1964 12 p refs Transl. into ENGLISH from Tetsu to Hagane (Tokyo), v. 45, Jan. 1959 p 40–45 (JPRS-25004; OTS-64-31442) OTS: $0.50

Age-hardening characteristics of nickel-base heat-resistant alloys were studied and were compared with carbide-precipitation-type heat-resistant alloys. Age hardening of nickel-base heat-resistant alloys is much faster and more intensified than that of carbide-precipitation-type alloys. Hardness after aging is above Bhn 300 within 10 hours at 750° C, though solution-treated hardness is below Bhn 230. Maximum aging hardness is attained at 750° C, and above this temperature the coagulation of precipitates becomes excessive and age hardness decreases rapidly. As the amount of Ti, Al, and Nb increases, hardness after aging or solution treatment increases. Addition of Mo increases hardness of Ni-Cr-Co alloys, though it does not affect Ni-Cr alloys. Nor does Co affect the hardness after aging or solution treatment. Author

N64-22745 Joint Publications Research Service, Washington, D.C.
JAPANESE STUDY OF MECHANICAL PROPERTIES AT ELEVATED TEMPERATURE OF SOME COMMERCIAL Ni-BASE RESISTANT ALLOYS
Taro Hasegawa 3 Jun. 1964 12 p ref Transl. into ENGLISH from Tetsu to Hagane (Tokyo), v. 45, no. 7, Jul. 1959 p 34–38 (JPRS-24919; OTS-64-31401) OTS: $0.50

This report discusses a review of earlier data on the effect on mechanical properties resulting from the addition of Ti, Al, Nb, Mo, or Co, to commercial alloys. Conclusions are given from a comparison of the six types of Ni-base heat-resistant alloys according to the effects of the addition of Mo, Co, or Nb. G.D.B.

N64-22750 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
EFFECTS OF INTERSTITIAL IMPURITIES ON THE LOW-TEMPERATURE TENSILE PROPERTIES OF TUNGSTEN
Joseph R. Stephens Washington, NASA, Jun. 1964 16 p refs
(NASA-TN-D-2287) OTS: $0.50

A study was undertaken to determine the effects of the interstitial impurities of oxygen and carbon on the mechanical properties of polycrystalline tungsten and high-purity tungsten single crystals. Results of tensile tests showed that additions of both oxygen and carbon to polycrystalline tungsten produced a marked increase in the ductile-to-brittle transition temperature. Oxygen and carbon produced a much smaller increase in the transition temperature of the single-crystal specimens. Addition of oxygen to polycrystalline tungsten lowered both the ultimate tensile strength and the yield

strength, but had no measurable effect on the strength properties of single-crystal specimens. Carbon additions to both polycrystalline and single-crystal specimens did not affect the ultimate tensile strength; however, a large increase in the yield strength resulted. Author

N64-22893 Frankford Arsenal, Philadelphia, Pa.
DENSITY CHANGES ON ANNEALING COLD-WORKED MOLYBDENUM
Harry W. Antes Reprint From Trans. of the Met. Soc. of Aime., v. 230, Apr. 1964 8 p refs
(FAA-64-6; AD-440507)

The density changes that occurred on annealing cold-worked polycrystalline molybdenum, over the temperature range of 870° to 1630° C, were determined. Increases in density were observed for recovery and the beginning of recrystallization. An initial decrease in density was observed during recrystallization. A second decrease in density was observed after recrystallization was completed, as the microstructure changed from columnar grains to equiaxed grains. Both decreases in density were associated with an increase in grain boundary area to volume ratio. The second decrease in density was observed in the annealing range that immediately precedes secondary recrystallization, as reported in the literature. Author

N64-22917 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
THE EFFECTS OF HIGH-PRESSURE, HIGH-TEMPERATURE HYDROGEN ON STEEL
E. E. Fletcher and A. R. Elsea 26 Mar. 1964 77 p refs
(Contract AF 33(615)-1121)
(DMIC-202; AD-601389)

This report deals with the deleterious effects of hydrogen gas on steel at elevated temperatures and/or pressures. Hydrogen attack on steels is manifest as decarburization, intergranular fissuring, or blistering. These conditions result in lowered tensile strength, ductility, and impact strength. The reaction of hydrogen with iron carbide to form methane is probably the most important chemical reaction involved in the attack on steel by hydrogen. Factors that determine the degree of attack are temperature, hydrogen partial pressure, stress, exposure time, composition of the steel, and structure of the steel. Attack of steel at elevated temperatures and pressures is limited or prevented by the following measures: (1) use of steel alloyed with strong carbide-forming elements; (2) use of liners of resistant alloy steels; and (3) substitution of resistant nonferrous alloys. Author

N64-22919 Army Materials Research Agency, Watertown, Mass.
EFFECT OF TEMPERING ON NOTCH PROPERTIES OF D6AC ALLOY STEEL SHEET
Robert N. Katz Dec. 1963 17 p refs
(AMRA-TR-63-35; AD-431311) OTS: $0.50

A study of the strength and notch properties of D6AC (consumable electrode, vacuum-melted Cr-Mo-V) steel sheet, 0.040-in. thick, was conducted to evaluate the effect of tempering for various test temperatures. Smooth tensile, edge-notched tensile, and precracked subsize Charpy specimens were employed. Tempering in the range of 1,000° to 1,100° F provided good fracture toughness with slight loss in strength properties that would be expected at higher tempers. The results are compared with burst tests conducted on Shillelagh motor cases made from the 0.040-in.-thick D6AC steel. Author

N64-22921 Titanium Metals Corp. of America, New York, N.Y.
DEVELOPMENT OF A STABLE-BETA TITANIUM ALLOY Quarterly Report No. 5, Jul. 1–Sep. 30, 1963
D. B. Hunter [1963] 51 p
(Contract DA-30-069-ORD-3743)
(NAL-TR-405/2-4; AD-435698)

Tensile and bend tests were performed on the three base alloys, Ti-17V-10Cr-3Al, Ti-8Mo-8V-7.5Fe-3Al, and Ti-15Mo-5Fe-3Al, containing additions of up to 5% Cu, Ni, and Co. Ultimate strengths in the range 160,000 to 170,000 psi accompanied by good ductility were found for these alloys in both annealed and aged conditions. Complete replacement of Cr or Fe by Cu in the base alloys resulted in brittleness upon aging at 900° F. Addition of up to 1% Si to Ti-17V-10Cr-3Al increased tensile strength but lowered ductility after aging. Investigation of two metastable beta alloys was undertaken in the compositional range Ti-17V-(1.5 to 4)Fe-3Al and Ti-8Mo-8V-(1 to 3)Fe-3Al, by hardness and tensile tests; and also investigated were two compositional ranges of stable nonhardening beta alloys, Ti-17V-(10 to 12)Mn-3Al and Ti-8Mo-8V-(6 to 7)Fe-3Al, by tensile, bend, and impact tests. These indicated that Ti-17V-4Fe-3Al and Ti-8Mo-8V-1Fe-3Al were the better metastable beta alloys, and Ti-17V-11Mn-3Al and Ti-8Mo-8V-6Fe-3Al the preferable stable alloys.
Author

N64-22948 Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
DIFFUSION IN BODY-CENTERED CUBIC METALS ZIRCONIUM, VANADIUM, NIOBIUM, AND TANTALUM
Ted Sadler Lundy (Ph.D. Thesis—Tenn. U.) Jun. 1964 163 p refs
(Contract W-7405-ENG-26)
(ORNL-3617)

The Arrhenius-type expression with constants D_0 and Q, $D = D_0\exp(-Q/RT)$, cannot be used generally to describe the temperature dependence of diffusion coefficients in body-centered cubic metals over wide temperature ranges. For diffusion in beta zirconium, expressions of the form $D = AT^B \exp(C/T)$ were found to describe accurately the experimental data over the whole temperature range. This expression is similar to that sometimes used to describe vapor-pressure behavior. Experimental results and elementary relationships are given for other metals, including niobium and tantalum. D.E.W.

N64-22954 Fansteel Metallurgical Corp., North Chicago, Ill.
COLUMBIUM ALLOY SHEET ROLLING PROGRAM Interim Report, 7 Jul.–6 Sep. 1963
W. O. Gentry and H. A. Moreen 7 Sep. 1963 7 p refs
(Contract NOw-63-0231-c)
(IR-3; AD-419992)

Conversion of nominal 6-in.-diam by 300-lb ingots of FS-85 (Cb-27Ta-10W-1Zr) and B-66 (Cb-5V-5Mo-1Zr) to sheet bar has been completed. Data on this conversion are presented. Author

N64-22958 Alloyd Electronics Corp., Cambridge, Mass.
PREPARATION OF HIGH-PURITY BERYLLIUM Progress Report no. 2, 1 Nov. 1963–1 May 1964
W. T. Hess and M. J. Hordon [1964] 52 p refs
(Contract AF 33(657)-11743)
(AD-440233)

Refined beryllium metal was produced by a distillation process involving crucible-free melting and evaporation by

electron beam techniques. With deposition rates up to 20 g/hr, beryllium deposited onto a heated condenser plate showed significant reductions in the ratio of 5:1 in copper, nickel, and oxygen contamination compared to the starting material. Impurity elements such as aluminum, iron, and silicon were also decreased to a lesser extent; oxygen concentration varied inversely with deposition rate. Author

N64-22973 Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
EFFECT OF TEMPERATURE ON THE FRACTURE STRENGTH OF Ti-6Al-4V ALLOY SHEET
E. F. Kaluza 6 Nov. 1963 12 p refs
(SM-44640)

Shallow cracks of varying size were induced in tensile specimens, which were subsequently tensile tested at room temperature, −100° F, −321° F, and −423° F. The critical crack depth of specimens tested at −423° F and −321° F was found to be 0.009-in. deep. The critical crack depths appear to be approximately 0.015 in. for the −100° F evaluation and 0.011 in. for the room-temperature evaluation. The increase in crack sensitivity from room temperature to −321° F was very slight. The fracture strength slopes at room temperature, −100° F, and −321° F were approximately −500, −700 and −1,000 psi per 0.001 in. of additional crack depth, respectively. At −423° F, however, an abrupt increase in crack sensitivity was observed as evidenced by a slope of −5,300 psi per 0.001 in. of additional crack depth. Author

N64-22974 Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
THE DELAYED FAILURE CHARACTERISTICS OF MARAGING STEELS
V. Kerlins 7 Oct. 1963 25 p refs
(SM-43114)

A limited amount of data are available on the delayed failure susceptibility of the new maraging steels. The delayed failure characteristics of 4340 steel and maraging steel were evaluated in various corrosive media. The maraging steel parent and weld material were superior to 4340 steel in resistance to the effects of corrosive environments. Author

N64-22985 Massachusetts Inst. of Tech., Cambridge
WORK FUNCTION AND DESORPTION ENERGIES AND RATES OF REFRACTORY METALS COATED WITH CESIUM
Elias P. Gyftopoulos *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 117–131 refs (See N64-22976 16-09)

This paper gives the theoretical correlation of electron work function and atom and ion deabsorption energies and deabsorption rates for metallic surfaces coated with cesium. The basis of the derived correlations is the assumption that, in the intermetallic absorption systems, the adsorbate particles are chemisorbed as a single species and that they are held onto the substrate by partially ionic and partially covalent bonds. The chemical nature of the surface bonds is suggested by their magnitude in the order of ev. This physical chemical approach to the problem of theoretical correlations for the work function, desorption energies, and desorption rates in intermetallic adsorption systems, yields results that are in good agreement with experimental data for cesium on different substrates. C.L.W.

N64-23000 Naval Applied Science Lab., Brooklyn, N.Y. Material Sciences Div.
REPORT OF INSPECTION AND PROGRESS IN APPLICATION OF SATELLITE 6B OVERLAYS OF HIGH POINT (PC(H)-1) Technical Memorandum No. 4
5 Feb. 1964 17 p
(USNASL-9110-P-IJ; AD-428909)

This report covers the inspection of the foil and strut assemblies of PC(H)-1. Discussed are: (1) inspection of eroded and other areas of PC(H)-1; (2) fabrication and installation procedures for satellite overlays to eroded areas; (3) adhesive tests conducted to develop adhesion-bonding procedures; and (4) future action based on the inspection and changes in propeller specifications. N.E.A.

N64-23015 Oak Ridge National Lab., Tenn.
EFFECTS OF HYDROGEN ON THE HIGH-TEMPERATURE FLOW AND FRACTURE CHARACTERISTICS OF METALS
H. E. Mc Coy, Jr. (Ph.D. Thesis—Tenn. U.) Jun. 1964 286 p refs
(Contract W-7405-ENG-26)
(ORNL-3600)

This report describes an evaluation of the high-temperature mechanical behavior of several metals in hydrogen. Comparative creep–rupture testing in argon and hydrogen environments was the primary method used to evaluate the mechanical behavior. The materials studied included two heats of Inconel, Nickel 200, Nickel 270, an electron-beam zone-refined melt of nickel, high-purity copper, Armco iron, electrolytic iron, and type 304 stainless steel. All of the nickel-base materials and the copper exhibited inferior creep resistance in hydrogen; the iron-base materials were not influenced by the environment. Hydrogen had a large effect on pure nickel and copper, the magnitude decreasing with decreasing purity. Several additional experiments were run in an effort to determine the responsible mechanism. N.E.A.

N64-23017 General Electric Co., Schenectady, N.Y. Research Lab.
SUPERCONDUCTIVE INTERMETALLIC COMPOUNDS
B. W. Roberts Jan. 1964 59 p refs
(Rept.-64-RL-3540M)

Superconductive intermetallic compounds (excluding those containing elements D, H, B, C, N, O, and S) are reviewed with emphasis on the available parameters relating to electronic properties. Substantial data now exist to support the BCS prediction that high densities of states at the Fermi surface lead to high superconductive critical temperatures and are the physical basis for Matthias' rules. In accord with this is the existence of superconductivity in most of the known Cr_3O-type (β-W) compounds. Also, the hexagonal and cubic Laves phases, α-Mn-type compounds, and the sigma phases are frequently found to be superconductive. These structure types are sometimes referred to as electron compounds. The critical temperatures are highest for compounds with valence electron-to-atom ratios of about 4.7. A secondary peak occurs at about 6.6. The critical temperature in some cases is sharply dependent upon mean atomic volume and the valence electron density. Author

N64-23065 Lear Siegler, Inc., Santa Monica, Calif. Astro Structures Div.
SPIN FORGE PROCESSING OF THE 300 KSI GRADE MARAGING 18% Ni STEEL
Richard P. Sernka [1963] 21 p

An evaluation of the response of 300-ksi grade maraging steel to shear spin processing and the results of such processing on the mechanical properties of the steel are presented in graphic and tabular form. I.v.L.

N64-23206* Thompson Ramo Wooldridge, Inc. Cleveland, Ohio Electrical Div.
THE PERMEATION OF HYDROGEN THROUGH MATERIALS FOR THE SUNFLOWER SYSTEM Final Report
E. A. Steigerwald 15 Nov. 1963 100 p refs
(Contract NAS5-462)
(NASA-CR-54004; ER-5623) OTS: $8.60 ph

Tungsten possessed the lowest permeability to hydrogen of any material evaluated. Metallic coatings that formed intermetallic coatings with the base metal were also effective hydrogen barriers. In the metal coated systems evaluated, a tungsten-silicon coating on a Haynes 25 base metal exhibited the lowest permeability. At the higher temperature, however, there was a general tendency for the intermetallic coatings to deteriorate as a result of gross diffusion into the base metal. Oxide coatings produced, in situ, on the stainless steel or Haynes 25 base metal were effective hydrogen barriers at the lower temperatures, but the barrier properties deteriorated at the higher temperatures owing to chemical reduction of the oxide by the hydrogen. Glass coatings had very low permeability to hydrogen; however, many of these barriers were susceptible to spalling. A Solaramic glass coating possessed the best overall properties of any coating tested on the basis of hydrogen permeability, ease of application, and long-time stability. Author

N64-23213 Marquardt Corp., Van Nuys, Calif.
COATINGS FOR EXTREME TEMPERATURE ENVIRONMENTS
M. J. Albom [1964] 35 p refs Presented at the Symp. of Protective Coatings in the Aerospace Ind., Am. Inst. of Chem. Engr., Pittsburgh, 17–20 May 1964

The distinction of being material pacesetters in the aerospace industry may rightfully be bestowed upon high temperature oxidation resistant coatings. Refractory metals, commonly used for extreme temperature environments, lack oxidation resistance and are therefore restricted to operating temperatures around 3,000° F because of coating limitations. Intermetallic or diffusion type coatings such as silicides and aluminides were investigated extensively. Major emphasis was placed on the silicides due to their superior protectiveness of widely used molybdenum. Aluminide coatings are currently under investigation, particularly for columbium and tantalum alloys. Significant coating improvements for the silicides resulted in increasing the oxidation resistance at 3,100° F from 30 minutes to approximately 5 hours. Similar improvements but not to the same degree were obtained with the aluminides. Three problems that make the evaluation of specific coatings extremely difficult are the questionable accuracy of temperature recording instrumentation, the effect of emittance on temperature, and the lack of a standard coating evaluation test procedure. Awareness of the first two problems plus good laboratory practice can minimize their effect. Until such time as a standard procedure is established and accepted, reported test results should be accompanied by a complete set of test conditions. Only in this way can a sound judgement be made about the usefulness of a specific coating. Author

N64-23250 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
VACUUM DEGASSING IN THE PRODUCTION OF PREMIUM-QUALITY STEELS
P. J. O'Reilly 11 Mar. 1964 126 p refs
(Contract AF 33(615)-1121)
(DMIC-200)

This report gives the experiences of several steel producers and consumers with vacuum degassing as a melting practice in the manufacture of high-strength steels for critical applications. The parameters involved in determining the effects of melting practice on mechanical properties are outlined. Pertinent melting processes are described and evaluated qualitatively. In presenting the data, vacuum degassing is compared with other melting practices such as conventional air melting and consumable-electrode vacuum-arc remelting (CEVAR). Generally, there is a trend indicating that vacuum degassing is being used in some production applications instead of air-melted or CEVAR material. In terms of higher and more uniform transverse tensile properties and impact strength, longer fatigue life, and improved cleanliness, the CEVAR alloys were the best. Vacuum degassing by any of the various methods resulted in an improvement in properties of air-melted alloys. The quality of CEVAR alloys could be approached when stream degassing or Dortmund–Horder treatment was applied to air melts, in some instances. Recommendations are given for additional investigations on the effects of melting practice on mechanical properties of premium-quality steels. Author

N64-23260 Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
METALLOGRAPHY AND AGING CHARACTERISTICS OF HASTELLOY B
J. R. Riddle and R. J. Gray Jun. 1964 34 p refs
(Contract W-7405-ENG-26)
(ORNL-2496) OTS: $1.00

Investigations of the high-temperature properties of Hastelloy B showed that age hardening strongly influences the mechanical properties of the material. Microstructures and hardness data for isothermal heat treatments at five temperatures between 700° and 1,000° C for periods to 1,600 hr are given. To show the effects of aging, etching conditions are duplicated as closely as possible, and the details of the microstructures are shown at high optical magnifications and in electron micrographs. Polishing and etching techniques are also described. The largest increase in hardness occurred at the lowest temperature of the investigation, 705° C, due to precipitation in the form of Widmanstätten platelets. Evidence is presented that indicates the platelets to be Ni_3Mo. The spheroidal carbides in wrought Hastelloy B are shown to have an M_6C structure. Author

N64-23276* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
EFFECTS OF SEVERAL PRODUCTION AND FABRICATION VARIABLES ON SHARP NOTCH PROPERTIES OF 5Al-2.5Sn TITANIUM ALLOY SHEET AT LIQUID HYDROGEN TEMPERATURE
J. L. Shannon, Jr., and W. F. Brown, Jr. Repr. from Proceedings of the Amer. Soc. for Testing and Mater., Philadelphia, v. 63, 1963 p 809–829 refs
(NASA-RP-201)

This paper presents an investigation to determine the influence of the following alloy production and the fabrication variables on the smooth and sharp-notch strength of 5Al-2.5Sn titanium alloy sheet: (1) sheet thickness; (2) small

amounts of cold rolling such as might be applied in flattening; (3) stretching in axial tension; (4) cooling rate from the annealing temperatures; and (5) fusion welding. Investigations of sheet thickness involved tests, over a range of low temperatures, on material at three interstitial levels. The majority of the remaining variables were studied at −423° F, with the use of a low-interstitial composition typical of that which might be specified for liquid-hydrogen service. N.E.A.

N64-23315 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ANODIC ANTICORROSION PROTECTION OF STEEL
Milan Prazak 3 Mar. 1964 14 p refs Transl. into ENGLISH from Hutnicke Listy (Prague), v. 11, no. 11, 1956 p 644–648
(FTD-TT-64-21/1+2; AD-435641)

On the basis of potential polarization curves of steel in sulfuric acid solutions, the difference between cathodic and anodic methods of applying anticorrosion protection to steel materials is explained. A theoretical discussion is presented of the conditions necessary to maintain the metal in a passive state (in the zone of anodic protection). Experimental evidence is presented that demonstrates the effectiveness of anodic protection of stainless steel. R.T.K.

RESET OF N64-23318

N64-23318 Air Force Systems Command, Wright-Patterson AFB Foreign Technology Div.
MAXIMUM GAS-BUBBLE PRESSURE METHOD AS APPLIED TO DETERMINATION OF SURFACE TENSION OF METALS OF THE IRON FAMILY
V. V. Fesenko and V. N. Yeremenko (Akad. Sci. Ukr. SSR) *In its* Transactions of the Seminar on Heat-Resistant Materials 1959 p 23–44 refs (See N64-23316 16-01)

A general method is developed for computing surface tension by the method of maximum gas bubble pressure, taking the wetting angle into account in cases where the liquid does not wet the interior of the capillary. The surface tension of nickel measured in helium at temperatures of 1,500°, 1,600°, and 1,700° C was 1,520 ±60 ergs/cm^2, and was virtually independent of temperature. The surface tension of cobalt was measured at 1,600° C in hydrogen and helium. The surface tensions of electrolytic iron and or iron produced by vacuum sublimation were measured. The surface tension of iron does not depend on the nature of the gas, at 1,650° C, and the values obtained were 1,260 ±90 and 1,415 ±90 ergs/cm^2, respectively. P.V.E.

N64-23325 Michigan U., Ann Arbor Radiation Lab.
STUDIES OF SCATTERING BY CELLULAR PLASTIC MATERIALS Final Report, 17 Jun. 1963–31 Mar. 1964
E. F. Knott and T. B. A. Senior Apr. 1964 83 p refs Prepared for Gen. Dyn./Fort Worth
(Rept.-5849-1-F)

The overall purpose of the contract was to investigate the use of cellular plastics as target supports for radar scattering ranges. Work was done in the following areas: (1) material considerations—cellulose acetates, epoxies, polystyrenes, silicones, urea formaldehydes, urethanes, vinyls; (2) scattering by cellular materials—establishing mathematical models to predict observed effects and to define controlling parameters; (3) back-scattering cross sections of Styrofoam cylinders—electrical, physical, and mechanical properties; (4) effect of size, shape, surface treatment, and internal joints on radar cross section; and (5) surface-wave effects near a Styrofoam cylinder. E.K.R.

N64-23342 California U., Berkeley Lawrence Radiation Lab.
THE SHAPE OF DEFORMATION TWINS
Roger E. Cooper May 1964 32 p refs
(Contract W-7405-ENG-48)
(UCRL-11451) OTS: $0.75

The case of wedge-shaped elastic twins has been examined in detail from two points of view—force and energy—and under two types of stress variation. The method involves the calculation of forces acting on individual twinning dislocations and shows the way in which the dislocation density varies along the twin length. The shape assumed by a twin depends primarily upon the magnitude of shear stress necessary to form it and the way in which this shear stress varies along the length of the twin. The surface energy determines only the shape near the tip of the twin. This behavior is summarized in the form of sketches of twin profiles. Author

N64-23353* National Aeronautics and Space Administration, Washington, D.C.
MATERIALS FOR SUPERSONIC TRANSPORTS
Richard H. Raring N.Y., AIAA [1964] 8 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-354) AIAA: $0.50 members, $1.00 nonmembers

A brief summary is presented of the status of materials development for supersonic transport, taking into account the work on structural alloys for this specific use. Material-rating parameters for supersonic transports are discussed, and a list of alloys screened for use in supersonic transports is given. Strength, fatigue, residual static-strength stability of microstructure, creep, corrosion, and coating of the research materials are specifically discussed. N.E.A.

N64-23362 Oak Ridge National Lab., Tenn.
ELECTRONUCLEAR DIVISION MEASUREMENT AND SHELL MODEL INTERPRETATION OF THE LOW-LYING NUCLEAR ENERGY LEVELS OF NIOBIUM-92
R. F. Sweet (Ph.D. Thesis–Texas U.) Jun. 1964 103 p refs
(Contract W-7405-ENG-26)
(ORNL-3638) OTS: $2.25

This study describes a nuclear shell model. The experimental procedure is presented in terms of the cyclotron, detection systems, 60° and 75° magnets, system resolution, plate camera, development of nuclear emulsions, and other considerations. The experimental data are given as an energy determination for the states of Nb^{92}, a tabulation of energy and intensity, and extraction of spectroscopic factors. Theoretical interpretations and conclusions discuss the form of the Nb^{93} wave function, racah algebra, evaluation of the spectroscopic factor, and determination of spins. G.D.B.

N64-23379 Pfaudler Co., Rochester, N.Y.
DEVELOPMENT OF A CEMENTATION COATING PROCESS FOR HIGH-TEMPERATURE PROTECTION OF MOLYBDENUM
P. J. Chao, B. S. Payne, Jr., and D. K. Priest Wright-Patterson AFB, Ohio, Materials Lab., Mar. 1964 101 p refs
(Contract AF 33(616)-7192)
PF-61-9; ML-TDR-64-55; AD-436003)

A pack cementation coating process was successfully developed to protect molybdenum alloy entry vehicle components against oxidation at temperatures near 3,000° F. Designated PFR-6, the 2 to 3 mil diffusion coating is a silicide prepared

from a siliconizing pack containing small amounts of columbium powder. It was evaluated statistically in an Analysis of Variance study to demonstrate an average lifetime of 1.36 hr in an oxyacetylene torch at a temperature exceeding 3,000° F. The 95% confidence limit is 0.81 to 1.91 hr at the same temperature. Three major process concepts were studied: single-cycle codeposition, multicycle codeposition, and multicycle alternate layer coatings. An intensive study of processing and testing variables employing a formal statistical approach resulted in the choice of the single-cycle PFR-6 coating for process optimization. Author

N64-23381 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

BONDING AGENTS AND THE TECHNOLOGY OF ADHESIVE BONDING

D. A. Kardashov, ed. 6 Jun. 1963 392 p refs Transl. into ENGLISH of the Book "Klei I Tekhnologiya Skleivaniya" Moscow, Oborongiz, 1960 p 1–285
(FTD-TT-62-1617/1+2; AD-413167)

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2. NATURE OF ADHESION PHENOMENA N. A. Krotova and L. P. Morozova p 21–31 refs

3. THE DIFFUSION THEORY OF ADHESION S. S. Voyutskiy p 32–47 refs

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9. THERMOSTABLE PHENOL-RUBBER ADHESIVES V. N. Solov'yeva and D. A. Kardashov p 154–167 refs

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13. SYNTHETIC ADHESIVES AND MPF-1 ADHESIVE SHEET L. M. Slepakov, Ye. A. Apartseva, S. F. Korzyukova, and I. I. Mikhalev p 187–190 refs

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16. THERMOSTABLE ADHESIVES FOR GLUING SILICONE RUBBERS TO METALS S. K. Zherebkov, N. A. Danilov, A. M. Medvedeva, and I. P. Ivanova p 208–215 refs

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24. BONDING OF TEXTOLITES, GLASS TEXTOLITES AND FOAM PLASTICS TO THEMSELVES AND IN COMBINATION WITH METALS p 306–311 ref

25. USE OF BONDED AND BONDED-AND-RIVETED JOINTS IN AIRCRAFT REPAIR Yu. B. Goryunov p 312–320 refs

26. USE OF BONDED JOINTS IN AIRCRAFT MANUFACTURE Z. Z. Terent'yeva p 321–323

IV. METHODS OF TESTING AND INSPECTING BONDED JOINTS

27. MECHANICAL TESTING OF BONDED JOINTS B. I. Panshin p 324–338 refs

28. LONG-TERM STRENGTH AND ENDURANCE OF METAL-TO-METAL BONDED JOINTS I. T. Shvetsov and G. I. Buyanov p 339–352

29. MODERN METHODS OF FLAW DETECTION FOR BONDED JOINTS Yu. B. Lange p 353–375 refs

N64-23409 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ARGON-ARC WELDING WITH ADDITIONAL ARGON STREAM

A. A. Alov and V. M. Shmakov 4 Mar. 1963 10 p refs Transl. into ENGLISH from Svarochnoye Proizvodstvo (Moscow), no. 3, 1962 p 13–16
(FTD-TT-62-1754/1+2; AD-400539)

A description is given of argon arc welding with the employment of an additional stream of argon to increase the depth of melting of the basic metal. The dependence of stream dimensions upon the consumption of argon in the additional stream was determined. At optimum consumption of the additional argon stream the depth of melting increased twofold as compared to welding without the additional stream. A.W.

N64-23435 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

STUDYING THE OXIDATION OF NIOBIUM BASE ALLOYS

V. I. Grigorovich and A. I. Dedyurin 10 Jan. 1964 37 p refs Transl. into ENGLISH from Metallurgiya, Metallovedeniye, Fiziko Khimicheskiye Metody Issledovaniya, Tr. Inst. Met., AN SSSR, no. 12, 1963 p 214–240
(FTD-TT-63-1020/1+2; AS-429962)

The effect of additions of alloying admixtures (titanium, chromium, vanadium, and molybdenum), in quantities of from 2 to 10 at. %, on the scaling resistance and oxygen contamination of the binary alloy of niobium and zirconium (30 at. %) was investigated. The test samples were heated in air for

periods of 1, 3, 5, 10, and 20 hours, at temperatures of 500° and 1,000° C. Alloying of the binary alloy with the admixtures increased the scaling resistance of the alloy at 500° C by 1.5 times. Additions of molybdenum and vanadium (5 and 7 at. %, respectively) increased the scaling (at 1,000° C) resistance of the binary alloy, but a further increase in their concentration decreased the scaling resistance. Alloying the binary mixture with the admixtures only slightly changed the depth of the oxygen penetration. P.V.E.

N64-23453 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE TECHNOLOGY OF ADHESIVE BONDING OF METALS

J. Peterka *In its* Machine Eng. 28 Sept. 1962 p 17–38 refs (See N64-23451 16-01)

The article deals with the principal types of metal-bonding adhesives produced in Czechoslovakia. The technology of surface treatment before bonding is discussed, and methods suitable for practical application are recommended. The possibilities of increasing the strength of bonded joints by ultrasonic treatment and with the quality control of bonded joints are discussed. Author

N64-23457 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

METAL SCIENCE AND HEAT TREATMENTS OF METALS (SELECTED ARTICLES)

14 Nov. 1962 23 p refs Transl. into ENGLISH of 2 articles from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 1, 1962 p 38–40, 57–64
(FTD-TT-62-1169/1+2+4; AD-292186)

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1. THE EFFECT OF HIGH-TEMPERATURE PLASTIC DEFORMATION ON THE MECHANICAL PROPERTIES OF HEAT-RESISTANT NICKEL-BASE ALLOYS S. T. Kishkin, M. G. Lozinskiy, et al. p 1–7 refs (See N64-23458 16-18)
2. AN INVESTIGATION OF THE POLYGONIZATION OF MOLYBDENUM BY MEANS OF HIGH TEMPERATURE METALLOGRAPHY M. G. Lozinskiy, M. L. Bernshteyn, et al p 8–21 refs (See N64-23459 16-18)

N64-23458 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE EFFECT OF HIGH-TEMPERATURE PLASTIC DEFORMATION ON THE MECHANICAL PROPERTIES OF HEAT-RESISTANT NICKEL-BASE ALLOYS

S. T. Kishkin, M. G. Lozinskiy, S. Z. Bokshteyn, and Ye. N. Sokolkov *In its* Metal Sci. and Heat Treat. of Metals 4 Nov. 1962 p 1–7 refs (See N64-23457 16-18)

Thermomechanical treatment of the investigated nickel-base alloys leads, even under conditions of incomplete suppression of recrystallization, to a noticeable increase in the strength properties determined at room temperature, and to a sharp increase in plasticity. The hardening may be related to an increase in the amount of carbide phase, to a change in the fine crystalline structure of the material, and to a certain quality of texture. The sharp increase in the plasticity of the investigated alloys is due to the possibility of producing plasticity of the grain by preventing an intercrystalline rupture. G.D.B.

N64-23459 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

AN INVESTIGATION OF THE POLYGONIZATION OF MOLYBDENUM BY MEANS OF HIGH-TEMPERATURE METALLOGRAPHY

M. G. Lozinskiy, M. L. Bernshteyn, and T. V. Vershinskaya *In its* Metal Sci. and Heat Treat. of Metals 14 Nov. 1962 p 8–21 refs (See N64-23457 16-18)

The greater the hot hardness of a molybdenum alloy, the greater is the degree of prior deformation and the shorter is the holding time of the indentor on the specimen at test temperatures of 1,050°, 1,100°, and 1,150° C. The microhardness of deformed specimens at 1,050° C is reduced during the first 2 hours of holding. The X-rays showed that the crushing of blocks during deformation is characteristic of molybdenum G.D.B.

N64-23466 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PRINCIPLES OF PHYSICAL POWDER METALLURGY

V. S. Rakovskiy 26 Jul. 1963 122 p refs Transl. into ENGLISH of the Book "Osnovy Poroshkovogo Metallovedeniya" Moscow, Gos. Nauchno-Tekhn. Izd., 1962 p 3–86
(FTD-TT-62-1562/1+2; AD-422059)

CONTENTS:

1. INTRODUCTION p 1–3
2. GENERAL PRINCIPLES OF THE PHYSICAL METALLURGY OF CERMET MATERIALS p 4–58c refs (See N64-23467 16-18)
3. SPECIAL PROBLEMS IN THE PHYSICAL METALLURGY OF CERMET MATERIALS p 59–93a refs (N64-23468 16-18)
4. QUALITY-CONTROL METHODS IN PHYSICAL POWDER METALLURGY p 94–115 refs (See N64-23469 16-18)

N64-23467 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

GENERAL PRINCIPLES OF THE PHYSICAL METALLURGY OF CERMET MATERIALS

In its Principles of Phys. Powder Met. 26 Jul. 1963 p 4–58c refs (See N64-23466 16-18)

General principles of the physical metallurgy of cermet materials are given in terms of the interaction of solid surfaces, interaction with a liquid, metal powders and their properties, powder as a free-flowing material, plastic deformation, dynamics of the pressing process, sintering, and material strength. G.D.B.

N64-23468 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SPECIAL PROBLEMS IN THE PHYSICAL METALLURGY OF CERMET MATERIALS

In its Principles of Phys. Powder Met. 26 Jul 1963 p 59–93a refs (See N64-23466 16-18)

The special problems in the physical metallurgy of cermet materials include the reactions of high-melting compounds with one another and with metals. Friction and antifriction materials are also discussed. The characteristics of sintered high-melting metals and their alloys are described. G.D.B.

N64-23469 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

QUALITY-CONTROL METHODS IN PHYSICAL POWDER METALLURGY

In its Principles of Phys. Powder Met. 26 Jul. 1963 p 94–115 (See N64-23466 16-18)

Quality control is discussed in terms of grain size and its determination by the screen, microscopic, and sedimentation methods. The specific weight and volumetric characteristics are described. Specific surface, thermal conductivity, dilatometry, brittleness, modulus of elasticity, fractures, various tests, grinding, and polishing are all covered. G.D.B.

N64-23501 Joint Publications Research Service, Washington, D.C.
ARC-DISCHARGE METALLURGY
11 Jun. 1964 56 p refs Transl. into ENGLISH from the book "Elektroiskrovaya Obrabotka Metallov" Moscow, Publishing House of Acad. of Sci., 1963 p 104–133, 161–166
(JPRS-25054; OTS-64-31467) OTS: $1.50

CONTENTS:

1. A STUDY OF CRYSTAL STRUCTURE DEFECTS IN PURE METALS DURING SPARK DISCHARGE L. C. Palatnik, A. A. Levchenko, and V. M. Kosevich p 1–14 refs (See N64-23502 16-18)
2. RESIDUAL STRESSES AND DURABILITY IN HEAT-RESISTING MATERIALS AFTER SPARK TREATMENT V. P. Aleksandrov p 15–22 refs (See N64-23503 16-18)
3. MACROSCOPIC STUDY OF CHANGES IN THE STRUCTURE OF THE SURFACE LAYER OF STEELS AND ALLOYS AFTER ELECTRICAL DISCHARGE CUTTING I. Z. Mogilevskiy, Ya. L. Linetskiy, and S. A. Chepovaya p 23–34 refs (See N64-23504 16-18)
4. INVESTIGATION OF POWDERS—PRODUCTS OF SPARK EROSION MACHINING B. A. Krasyuk p 35–45 (See N64-23505 16-18)
5. ION BEAM DRILLING V. K. Popov and M. N. Kalinychev p 46–53 refs (See N64-23506 16-18)

N64-23502 Joint Publications Research Service, Washington, D.C.
A STUDY OF CRYSTAL STRUCTURE DEFECTS IN PURE METALS DURING SPARK DISCHARGE
L. C. Palatnik, A. A. Levchenko, and V. M. Kosevich *In its* Arc-Discharge Met. 11 Jun. 1964 p 1–14 refs (See N64-23501 16-18) OTS: $1.50

The formation of imperfections (dislocations, packing defects, and vacancies) in crystal structures was investigated. Dislocation defects were revealed by selective etching in single crystals of bismuth, antimony, and zinc. Vacancies and packing defects were revealed by X-ray methods in polycrystalline samples of pure metals (gold, silver, and copper). The investigation was concerned, in particular, with the distribution of dislocation defects appearing in single crystals under the action of spark discharges, and with the formation of vacancies and packing defects under the influence of spark discharges. P.V.E.

N64-23503 Joint Publications Research Service, Washington, D.C.
RESIDUAL STRESSES AND DURABILITY IN HEAT-RESISTING MATERIALS AFTER SPARK TREATMENT
I. P. Aleksandrov *In its* Arc-Discharge Met. 11 Jun. 1964 p 15–22 refs (See N64-23501 16-18) OTS: $1.50

The influence of the parameters of the pulses (used in electrospark treatment of metals) on the durability of the treated materials was investigated. A comparison was made between samples treated by the electrospark method and those treated by cutting. It was found that the pulse length essentially influences the durability of the tested alloys. Electrospark treatment with pulse lengths less than 250μsec did not cause a change in the durability of the alloy (EI437B) as did the initial samples treated by cutting. Samples treated with discharges of 480μsec pulse length showed a reduction in durability of the order of 10% to 15%; samples treated with 1,050μsec pulses showed durability reductions of 20% to 30%. In treating another steel alloy (EYaIT), the pulse length was found to have practically no effect on the durability. The great reduction in durability of EI437B alloy after treatment with pulses over 250μsec is explained by the formation of microcracks in the surface layer. P.V.E.

N64-23504 Joint Publications Research Service, Washington, D.C.
MACROSCOPIC STUDY OF CHANGES IN THE STRUCTURE OF THE SURFACE LAYER OF STEELS AND ALLOYS AFTER ELECTRICAL DISCHARGE CUTTING
I. Z. Mogilevskiy, Ya. L. Linetskiy, and S. A. Chepovaya *In its* Arc-Discharge Met. 11 Jun. 1964 p 23–34 refs (See N64-23501 16-18) OTS: $1.50

Metal shims cut with an electric discharge were studied for surface defects. The macrostructure of the surface of the shims upon etching revealed three zones—the central zone, and two outer zones that were of a different color from the central zone. Investigation of the macrosections after cutting of rod steel showed that under the same conditions the length of the outer zones was almost identical in thick and thin shims, but the thickness of the outer zones was somewhat greater in shims of greater thickness. This difference was not found with shims of over 10-mm thickness. P.V.E.

N64-23505 Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF POWDERS—PRODUCTS OF SPARK EROSION MACHINING
B. A. Krasyuk *In its* Arc-Discharge Met. 11 Jun. 1964 p 35–45 (See N64-23501 16-18) OTS: $1.50

Metallographic investigations of the metallic powder products of erosion of electrodes made of various alloys are described. A list of conclusions concerning the nature and amount of metal products is presented. P.V.E.

N64-23506 Joint Publications Research Service, Washington, D.C.
ION BEAM DRILLING
V. K. Popov and M. N. Kalinychev *In its* Arc-Discharge Met. 11 Jun. 1964 p 46–53 refs (See N64-23501 16-18)
OTS: $1.50

The principles of operation and power characteristics of an ion gun, used for drilling holes down to a minimum diameter of 5 microns in metalic and nonmetalic materials, are discussed. P.V.E.

N64-23511* Battelle Memorial Inst., Columbus, Ohio
THE DEVELOPMENT OF MAGNESIUM-LITHIUM ALLOYS FOR STRUCTURAL APPLICATIONS
T. G. Byrer, E. L. White, and P. D. Frost Washington, NASA, Jun. 1964 115 p refs
(Contract NAS8-5049)
(NASA-CR-79) OTS: $2.50

CONTENTS:

1. THE DEVELOPMENT OF MAGNESIUM-LITHIUM ALLOYS FOR STRUCTURAL APPLICATIONS T. G. Byrer, E. L. White, and P. D. Frost 34 p refs (See N64-23512 16-18)

2. CORROSION RESISTANCE AND CORROSION PROTECTION OF MAGNESIUM-LITHIUM ALLOYS: A REVIEW OF THE PRESENT STATE OF DEVELOPMENT 37 p refs (See N64-23513 16-18)

3. DATA SHEETS ON SURFACE TREATMENTS AND COATINGS FOR COMMERCIAL MAGNESIUM ALLOYS 40 p

N64-23512* Battelle Memorial Inst., Columbus, Ohio
THE DEVELOPMENT OF MAGNESIUM-LITHIUM ALLOYS FOR STRUCTURAL APPLICATIONS
T. G. Byrer, E. L. White, and P. D. Frost *In its* The Development of Magnesium-Lithium Alloys for Structural Applications Jun. 1964 34 p ref (See N64-23511 16-18)

The current program status includes the following: (1) The capability of LA141 to be warm-formed into typical aerospace parts, requiring simultaneous shrink and stretch operations, was demonstrated. Likewise, the ability of the alloy to be extruded through porthole dies into tubular sections having a wall 0.025-in. thick was shown. (2) The LA141 alloy was found to have machinability, in lathe tests, comparable to that of 2024 aluminum alloy at low feed rates, but much greater than the aluminum alloy at high feed rates. Both LA141 and LA91 were found to be readibly adaptable to metal removal by chemical machining. Phosphoric acid solutions appear to be suitable reagents in this respect. (3) Electroplating of copper, nickel, and aluminum on LA141 alloy was found to be feasible. (4) Brazing experiments revealed that existing brazing filler metals for commercial magnesium alloys are not suitable for magnesium–lithium alloys because of incompatible melting ranges. Appendices contain a review of the literature on corrosion behavior and protection of magnesium–lithium alloys and data sheets on surface treatments and coatings for commercial magnesium alloys. I.v.L.

N64-23513* Battelle Memorial Inst., Columbus, Ohio
CORROSION RESISTANCE AND CORROSION PROTECTION OF MAGNESIUM-LITHIUM ALLOYS: A REVIEW OF THE PRESENT STATE OF DEVELOPMENT
In its The Development of Magnesium-Lithium Alloys for Structural Applications Jun. 1964 p 37 refs (See N64-23511 16–18)

Results of investigations indicate the following: (1) Binary magnesium–lithium alloys, containing about 11% lithium, are a single-phase body-centered-cubic structure. These alloys have better corrosion resistance in salt water than do lower lithium alloys of the hexagonal structure. (2) Alloys of the LA141 type, that is, body-centered-cubic alloys with lithium contents in the range of 13% to 15% and with aluminum in the range of 0.5% to 2%, have reasonably good resistance to mild atmospheric conditions. (3) Magnesium–lithium–aluminum body-centered-cubic alloys that have up to 2% aluminum appear to have better corrosion resistance than do alloys having higher aluminum contents. (4) Magnesium–lithium–zinc alloys with about 11% lithium and low zinc content (2% to 5%) have corrosion resistance in salt water about equal to that of the magnesium–lithium–aluminum alloys with similar lithium and aluminum contents. (5) The light fluoride anodic coating provides a good paint base. (6) The stannate immersion coating provides useful protection when it is unpainted; it is also a good paint base. (7) An epoxy primer coat plus either an epoxy or other topcoat are probably the best paint systems. (8) Organotin inhibitors for the primer coat are found to be better than the chromates. Tin dust may be added with the organotin. I.v.L.

N64-23620 Bureau of Mines, Salt Lake City, Utah
SMELTING COPPER REVERBERATORY SLAGS TO RECOVER IRON OF LOW COPPER AND SULFUR CONTENT
V. E. Edlund 1964 18 p refs
(BM-RI-6481)

This report presents the results obtained in a study of the technical feasibility of recovering a usable pig iron by pyrometallurgical treatment of typical copper reverberatory slags. The iron in the slag was readily reduced with carbon, but the copper and sulfur content of the metal was best controlled by a three-stage procedure comprising the following: (1) melting the slag with pyrite to remove copper as a low-grade matte, (2) smelting the partly decopperized slag with fluxes and carbon to reduce the iron, and (3) refining the impure iron alloy from step 2 with a flush slag to remove sulfur and residual copper. Laboratory-scale tests demonstrated that washing with 8 wt % of pyrite lowered the copper content of a typical reverberatory slag from 0.58% to 0.12%. Subsequent smelting of a mixture composed of 70% decopperized slag, 25% lime, and 5% coke reduced 84% of the iron to metal containing 2.27% sulfur. This metal then was successfully desulfurized by treatment with a basic flush slag to produce a finished metal that contained, in percent, 93.5% Fe, 0.02% S, 0.26% Cu, and 4.9%C. Overall recovery of iron under the conditions of trial was about 80%. Author

N64-23621 Iowa State U. of Science and Tech., Ames Ames Lab.
A STUDY OF THE STRAIN-AGING AND BRITTLE-DUCTILE TRANSITION CHARACTERISTICS OF CHROMIUM
Kenneth Edwin Solie and O. N. Carlson Aug. 1963 129 p refs
(Contract W-7405-ENG-82)
(IS-745) OTS: $2.50

In this study the strain-aging characteristics of chromium have been divided into dynamic and static phases. In studying the dynamic effects, the mechanical parameter of primary concern has been the ultimate tensile strength. This quantity was determined at various strain-rates, and plots of ultimate tensile strength versus temperature were found to be characterized by the existence of double strain-aging peaks. Chromium has been observed to exhibit the static strain-aging characteristics of a return-of-yield point and an increase in flow stress after initial straining and subsequent aging. On the basis of data obtained during this phase of the investigation, it can be concluded that nitrogen is also responsible for the return-of-yield point. The brittle-ductile transition temperatures of single and polycrystalline chromium metal were studied as a function of nitrogen concentration and chromium nitride distribution. It was observed that the effect of nitrogen on the polycrystals as noted by other investigators is essentially reversed in the single crystals. Nitrogen is observed to cause an increase in the transition temperature of the material in the furnace-cooled condition, whereas little or no effect of nitrogen on the ductility transition is found in the quenched state. Author

N64-23628 Joint Publications Research Service, Washington, D.C.
PROCESSING HIGH-TEMPERATURE MAGNESIUM ALLOYS
M. Ye. Drits 15 Jun. 1964 56 p refs Transl. into ENGLISH of the Book "Magniyevyye Splavy Dlya Raboty Pri. Povy. Temp." (Moscow), Nauka 1964
(JPRS-25069; OTS-64-31474) OTS: $1.50

It is possible to create structural magnesium alloys for work at 300° to 400° C by using thorium as an alloying compound. The most promising composition for use as a structural material is an alloy containing up to 3% thorium and 0.5% to 1% manganese. The selection of the optimum composition of deformed magnesium alloy required special research, which is discussed in this report. G.D.B.

N64-23648 Columbia U., New York, N.Y. School of Engineering and Applied Science
STUDY ON YIELDING OF IRON
Eun U. Lee (Ph.D. Thesis) Feb. 1964 122 p refs
(Contract Nonr-266(61))
(TR-4; AD-435779)

The effect of quenching on the yield stress of iron was studied at extremely small carbon concentrations. Swedish iron wire specimens of various grain sizes were decarburized until they showed no yield point or strain aging (70 hours of wet-hydrogen treatment at 716° C). Afterward they were recarburized in an atmosphere of normal heptane and dry hydrogen at 716° C, were quenched at temperatures ranging from 130° to 730° C in room-temperature water, and were tensile tested. Carbon contents were measured by the internal friction technique. The variation of the parameters σ_i and K_y in the Petch equation, $\sigma_y = \sigma_i + K_y d^{-1/2}$, where σ_y is the lower yield stress and d is the grain diameter, was studied throughout the decarburization and recarburization process as well as after quenching. Author

N64-23674 Massachusetts Inst. of Tech., Cambridge Metals Processing Lab.
DEFORMATION PROCESSING OF ANISOTROPIC METALS Progress Report, 1 Jan.–29 Feb. 1964
D. H. Avery and W. A. Backofen Apr. 1964 15 p
(Contract NOw-63-0564-d)
(PR-4; AD-437583)

An experimental determination of the yield locus for a 3/16-in.-thick sheet of a 4%-Al 1/4%-O_2 α-titanium alloy was made. In general, agreement between experimental combined-stress points in the tension-tension quadrant with values calculated using plastic strain-rate ratios was within 4%. The (0002) pole figure for the alloy contained a sharp peak centered around the sheet normal. There is also some spreading to lower intensity, which is much more obvious toward the transverse direction. P.V.E.

N64-23704 Air Force Systems Command, Wright-Patterson AFB, Ohio Materials Lab.
FLEXIBLE FIBROUS MATERIALS AND COATINGS FOR EXPANDABLE RE-ENTRY SYSTEMS
Jack H. Ross *In its* Aerospace Expandable Struct. Mar. 1964 p 74–94 refs (See N64-23701 16-03)

It is shown that super alloy fibers of ultrafine diameter can be twisted into a textile-type yarn and woven into fabrics having almost any weave patterns. Utilization of standard textile-type equipment, slightly modified in the case of twisters, was proven feasible. Fabrics formed had superior mechanical characteristics as compared to monofilament fabrics. J.R.C.

N64-23705 Goodyear Aerospace Corp., Akron, Ohio
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF METAL FABRIC EXPANDABLE STRUCTURES FOR AEROSPACE APPLICATIONS
A. F. Foerster *In AFSC* Aerospace Expandable Struct. Mar. 1964 p 95–117 refs (See N64-23701 16-03)

Metal-fabric expandable structures, including AIRMAT structures, appear to have good promise for a number of aerospace applications. There are essentially three reasons for this: (1) the capability of fabric structures to be folded and packed into small spaces; (2) their good weight-to-strength ratio; and (3) in the case of reentry vehicles, their low wing loading and correspondingly low heat input. J.R.C.

N64-23881 Lockheed Missiles and Space Co., Sunnyvale, Calif.
FUSION WELDING OF MAGNESIUM AND MAGNESIUM ALLOYS An Annotated Bibliography, Jan. 1962–May 1963
Jack B. Goldmann and Helen Mc Cormick, comp. Jul. 1963 32 p refs
(SB-63-52; Rept.-4-11-63-3)

Major emphasis of this report is placed upon fusion welding (TiG and MiG processes) of Mg-Li and Mg-Th alloys, 1/4-in. minimum thickness, with comparable data on fusion welding by these same processes for specific alloys of magnesium other than Mg-Li and Mg-Th. Physical properties, metallurgy of the weld, and inert gas welding techniques are shown for these alloys, plus any available data on prewelding and post-welding techniques and property changes. Applications include material gages of 1/4-in. and over, in a variety of configurations. The bibliography deals with welding techniques and physical metallurgy of Mg-Li alloys, Mg-Th alloys, and Mg alloys other than Mg-Li and Mg-Th; MiG and TiG welding processes for magnesium and its alloys; plus a few references to advances in MiG and TiG welding techniques in general. Author

N64-23892 Grumman Aircraft Engineering Corp., Bethpage, N.Y.
EFFECT OF DISCONTINUITIES IN FUSION WELDED BUTT JOINTS
R. J. Heitzmann Apr. 1964 18 p ref
(ADR-02-14-64.1)

The effect of internal porosity on the fatigue life of butt welded 5456-H343 aluminum alloy plate tested with weld beads intact has been investigated. The correlation of observed defect level with the level previously established by radiographic inspection is discussed. Author

N64-23919 United Kingdom Atomic Energy Authority, Risley (Gt. Brit.) Authority Health and Safety Branch
RECOMMENDATIONS ON THE SAFE HANDLING OF ZIRCONIUM METAL AND ZIRCONIUM ALLOYS
G. H. Bulmer and A. Quinton [1963] 57 p refs
(AHSB-(S)-R-59) HMSO: 5s

Following a summary of the physical, chemical, and toxic properties of zirconium, the design features necessary to insure an adequate safety standard in the construction and installation of plant-in-process areas, laboratories, and stores are given. Where appropriate, statutory and nonstatutory regulations are quoted and used as a framework for specifying operational safety requirements for both normal and accident conditions. The special conditions applicable to the storage and disposal of unirradiated and irradiated zirconium are given with respect to the several forms of waste likely to be encountered. Author

N64-23925 Solar Aircraft Co., San Diego, Calif.
DIFFUSION BONDING OF REFRACTORY METALS Interim Technical Documentary Progress Report, No. 7, 29 Dec. 1962–28 Mar. 1964

A. G. Metcalfe, F. K. Rose, J. Dunning, and A. Zumbrunnen
10 Apr. 1964 78 p refs
(Contract AF 33(657)-8789)
(RDR-1322-7; AD-436096)

Bonding processes for D36, D43, B66, and TZM alloys have been reappraised and modified. Extensive testing of the six program alloys is in progress and includes tensile, shear, fatigue, and creep data on uncoated alloys; and tensile, fatigue, creep and oxidation tests on coated alloys. Author

N64-23934* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Electromechanical Div.
GENERATION OF LONG TIME CREEP DATA ON REFRACTORY ALLOYS AT ELEVATED TEMPERATURES Third Quarterly Report, 26 Dec. 1963–26 Mar. 1964
J. C. Sawyer and E. B. Evans 20 Apr. 1964 32 p
(Contract NAS3-2545)
(NASA-CR-54048) OTS: $3.60 ph

The generation of creep data on refractory metal alloys is discussed. The alloys to be investigated are candidate materials for turbine and tubing applications in space electric-power systems. The objectives of the program are to construct 14 creep units capable of operation at better than 1×10^{-8} torr and to conduct long-time creep tests over the range from 2,000° to 3,200° F. The progress summarized in this report concerns the following: (1) acceptance testing of the first vacuum creep unit; (2) further bench testing of the residual gas analyzer, optical pyrometer, and optical extensometer; and (3) selection of alloys. P.V.E.

N64-23945* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
TENSILE PROPERTIES OF TUNGSTEN-3% RHENIUM AT TEMPERATURES OF 1400 TO 2900° C IN VACUUM
J. L. Taylor 1 Apr. 1964 10 p refs
(Contract NAS7-100)
(NASA-CR-56462; JPL-TR-32-588) OTS: $1.10 ph

The tensile properties of recrystallized, doped powder-metallurgy tungsten –3% rhenium rod were determined from 1,370° to 2,930° C in vacuum at a strain rate of 0.02/min. A comparison is made with recrystallized, doped powder-metallurgy tungsten, which shows comparatively poor ductility, and plasma-flame single-crystal tungsten, a very ductile material. The variation of strain-hardening exponent with temperature is shown for the two powder metallurgy materials. Tungsten–3% rhenium has the highest strength and the lowest ductility of the three materials. At a test temperature of $\simeq$ 50% of the absolute melting point, both tungsten–3% rhenium and powder-metallurgy tungsten show decreased ductility and intercrystalline fracture associated with void formation and growth. Ductility does not increase with increasing temperature above $\simeq$ 65% of the absolute melting point for tungsten–3% rhenium, as it does for powder-metallurgy tungsten, and this is attributed to the absence of stress-induced grain growth during testing. Author

N64-23951 California U., Los Angeles
THE EFFECT OF THE ELASTIC INTERACTION ON THE KINETICS OF CLUSTER GROWTH
W. Grupen and G. Sines Feb. 1964 184 p refs
(Contract DA-ARO(D)-31-124-G505)
(Rept.-64-10; AROD-3870-1; AD-440353)

The effect of elastic interaction on the distribution of vacancies around disk clusters of substitutional solute atoms in quenched, supersaturated binary alloys is investigated. The effect of the vacancy atmosphere on the initial rate of growth of a disk cluster of copper atoms, three atoms in diameter, was also investigated. The effect of the elastic interaction on the retardation of the annealing-out of quenched-in vacancies was examined. G.D.B.

N64-23967 Rensselaer Polytechnic Inst., Troy, N.Y.
STRESS CORROSION CRACKING Final Report, 14 Jun. 1960–13 Jun. 1963
N. D. Greene 10 Jun. 1964 4 p refs
(Contract DA-30-069-ORD-3077)
(AROD-27213; AD-441219)

The aims of this program were to determine the environmental and electrochemical conditions producing stress-corrosion fracture of austenitic stainless steels, and to determine the effects of plastic strain on the dissolution kinetics of metals. Results and conclusions of this research are briefly described. G.D.B.

N64-23969 California Inst. of Tech., Pasadena Firestone Flight Sciences Lab.
DEVELOPMENT AND APPLICATION OF A HIGH SPEED CAMERA FOR METALLOGRAPHIC AND CREEP PROPAGATION STUDIES Final Report
W. H. Beebe, M. E. Jessey, H. W. Liu, S. R. Valluri, and M. L. Williams Wright-Patterson AFB, Ohio, ARL, Apr. 1964 98 p refs
(Contract AF 33(616)-6270)
(ARL-64-69; AD-601330) OTS: $2.25

The operating principles and construction features of a high-speed framing camera are presented. With this unit, up to 128 successive dynamic photographs were taken of the structure of a metal surface, using reflected light at framing rates up to 100,000 frames per second and at various fixed exposure times between 0.05 and 0.40 μsec. Large field reflected-light and transmitted-light photographs were recorded. Examples of the different types of pictures obtained with the unit are presented and briefly discussed. Author

N64-24005* National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
HIGH-TEMPERATURE COBALT-TUNGSTEN ALLOYS FOR AEROSPACE APPLICATIONS
John C. Freche, Richard L. Ashbrook, and Gary D. Sandrock New York, SAE [1964] Presented at Air Transport and Space Meeting, New York, 27–30 Apr. 1964 14 p refs
(SAE Paper-843D)

The average life at 1,850–F and 15,000 psi of the strongest previously reported alloy Co-25W-1Ti-1Zr-0.4C was doubled from 92 to 185 hr by small additions of chromium and rhenium. At 2,200° F and 5,000 psi the strongest alloy, Co-25W-1Ti-1Zr-3Cr-2Re-0.4C, had a rupture life of 23 hr; the elevated temperature rupture strength compared favorably with the strongest available conventional (high chromium) cobalt-base alloys. It is particularly significant that even the strongest alloys of this series were readily hot-rolled. Elongations as high as 31% were obtained at room temperature with annealed cold-rolled sheet specimens. Good ductility was obtained. Elevated temperature tensile strengths of annealed sheet of the strongest chromium- and rhenium-modified alloys were approximately the same as for the cast alloys. The elongation of the wrought material was substantially greater. Although the strongest alloys had a chromium content of only 3%, they did not oxidize catastrophically in air. When they were coated with a commercial aluminum-iron coating, oxidation in 300 hr at 1,900° F was negligible. Author

N64-24013 Army Missile Command, Huntsville, Ala. Propulsion Lab.
A TOUGHNESS EVALUATION FOR FIVE-PER-CENT Cr-Mo-V HOT WORKED DIE STEEL
William S. Crownover and James W. Wright, Jr. 30 Mar. 1964 35 p refs
(RK-TR-64-7; AD-436187)

A toughness study was made on commercially available 5%-chromium hot-worked die (H-11 type) steel sheet to determine its suitability for use in highly stressed components such as solid-propellant rocket motor casings. The material was examined for the effects of melting practice, furnace atmosphere, quenching media, tempering temperature, and testing temperature on the toughness properties of this type steel. To study the toughness of the material, the edge-notched fracture toughness and the notched-to-smooth tensile tests were used. Careful consideration should be given to other materials of equivalent strength for use in highly stressed components before selecting an H-11 type steel. Since this steel is sensitive to high stress concentrations and its toughness properties are so greatly dependent upon tempering temperature, operating temperature, and thickness, its choice would be marginal at best. Author

N64-24037* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THERMAL EXPANSION OF YTTRIA-STABILIZED ZIRCONIA
T. H. Nielson and M. H. Leipold Mar. 1964 2 p ref Repr. from The J. of the Am. Ceram. Soc., v. 47, no. 3, Mar. 1964 p 155 Presented at the 15th Pacific Coast Reg. Meeting, The Am. Ceram. Soc., Seattle, 17 Oct. 1962
(Contract NAS7-100)
(NASA-CR-56458; JPL-TR-32-600)

The thermal expansion of yttria-stabilized zirconia in air and in a high-oxygen atmosphere was measured. A mixture of zirconium oxide and 15 wt% yttrium oxide was calcined at 1,725° C for 6 hours. The resulting calcine was pulverized and aqueous slip cast into slugs that were fired at 1,700° C for 24 hours in an oxidizing atmosphere (95 wt% O_2 + 5 wt% N_2). The mean coefficient of thermal expansion varied from 9 to 13.2 × 10^{-6}/°C over the temperature range 200 to 2,200° C. There was no significant difference in the thermal expansion measured in the two atmospheres. P.V.E.

N64-24041* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE IRON, MAGNESIUM, CALCIUM, AND NICKEL DISTRIBUTION IN THE MURRAY CARBONACEOUS CHONDRITE
Kurt Fredricksson (Calif. U.), and Klaus Keil [1964] 24 p refs Presented at the 25th Ann. Meeting of the Meteorit. Soc. of Am., Socorro, N. Mex., 4–5 Sep. 1962
(Grant NsG-317-63)
(NASA-TM-X-54050) OTS: $2.60 ph

Distribution determinations of iron, magnesium, calcium, and nickel contents in olivine, pyroxene, and the layer lattice silicate material were made by means of electron microprobe techniques. Frequency-distribution diagrams are included. The high iron and nickel contents of the matrix and the low iron and nickel contents of most olivines indicate that the main mass of the matrix material did not originate through alteration of the high-temperature minerals in situ. Most of the olivines and pyroxences observed cannot represent debris of common chondrite types, as suggested by Ringwood, because their compositions differ markedly. E.C.

N64-24066 Hexcel Products, Inc., Berkeley, Calif. Advanced Structures Group
DEVELOPMENT EVALUATION OF A LIGHTWEIGHT ALUMINUM HONEYCOMB CASE Progress Report, Feb. 1964
M. I. Kazimi 10 Mar. 1964 42 p ref
(Contract DA-04-200-AMC-477(A))
(PR-2; AD-435521)

Work was done on a predevelopment study, design of the prototype case, fabrication of tooling and test equipment, and engineering drawing release. The predevelopment study was conducted to evaluate the design data and concepts to be used in the prototype design; the prototype design was completed. Fabrication of the basic tooling is approximately 80-percent complete. Author

N64-24104* ARA, Inc., West Covina, Calif.
CONCEPT OF MULTIPLE-IMPACT STUDY OF ENERGY ABSORPTION First Quarterly Progress Report, 1 Apr.–1 Jul. 1963
David L. Platus, Patrick J. Cunningham, and Frank A. Marovich 1 Jul. 1963 40 p refs
(Contract NAS7-226)
(NASA-CR-56548; ARA-23; TR-1)

Flow and fatigue characteristics of ductile metals under cyclic plastic straining are summarized in relation to multiple-impact energy absorbing devices. Pertinent material parameters are identified, and certain behavior trends based primarily on low-cycle-rate tests reported in the literature are discussed. From these observations idealized analytical models are developed for describing the behavior of cyclic-strain energy absorption devices utilizing metals. An experimental program utilizint cyclic torsion tests, and aimed at extending the cyclic strain data to impact cycling conditions and at verifying the analytical models, is discussed. A complete description of the test apparatus is presented. Author

N64-24126 North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
DETERMINATION OF MECHANICAL AND THERMOPHYSICAL PROPERTIES OF COATED REFRACTORY AND SUPERALLOY THIN SHEET
D. C. Root and C. H. Savage Wright-Patterson AFB, Ohio, Res. and Technol. Div., Nov. 1963 199 p refs
(Contract AF 33(657)-9416)
(SID-63-956; RTD-TDR-63-4068; AD-426033)

The mechanical properties of foil gages of the D-36 and B-66 columbium and TZM molybdenum alloys were determined in coated and uncoated conditions at temperatures through 2,700° F. Test specimens of D-36 and TZM were coated by a two-step, pack-cementation Si-Cr-B process. The B-66 was coated with Durak KA coating. The René 41 and Hastelloy X superalloy foils were evaluated at temperatures through 1,900° F without coating. The tests made on these alloys were tensile, notch tensile, fatigue, creep, thermal cycling, thermal shock, dynamic modulus, oxidation, bend, recrystallization, simulated micrometeoroid impact, and microstructural examination. Two furnaces are described. One was designed for testing bare refractory alloys in vacuum at high temperatures, and the other for testing coated refractory alloys at elevated temperatures. Development of a mechanical extensometer capable of measuring strain in a tensile test at 2,700° F is discussed. Author

N64-24164 Tennessee U., Knoxville
OXIDATION OF CESIUM AT LOW TEMPERATURES AND PRESSURES

E. E. Stansbury and J. E. Epperson Arnold Eng. Develop. Center, May 1964 21 p refs
(Contract AF 40(600)-1023)
(AEDC-TDR-64-111; AD-600428)

The research indicated that the oxidation of cesium is very rapid for oxygen pressures approaching 10^{-3} torr at 0° C but is very small at −78° C. At intermediate temperatures, the oxidation curves exhibit the break away phenomenon observed for other alkali metals in which an accelerating rate of oxidation is observed following an initial slow rate. Author

N64-24174 Union Carbide Corp., Lawrenceburg, Tenn. Advanced Materials Lab.
PYROLYTIC COATING OF CARBON FILAMENTS Quarterly Progress Report, 15 Aug. – 15 Nov. 1963
30 Nov. 1963 78 p
(Contract AF 33(657)-11297)
(AD-437595)

The pull strength of carbon yarn was increased up to three times by continuously depositing a coating of pyrolytic carbon on the yarn filaments. The yarn was heated to coating temperature both by electrical resistance heating and by radiation. A uniform coating on all filaments in the yarn cross section was achieved, as determined by microscopic inspection. The significant process variables were defined as methane concentration in the coating gas and deposition temperature. The electrical resistance was reduced by a factor of 3 through application of the pyrolytic carbon coating. It was estimated that the thermal conductivity of the yarn was increased by the same amount. Author

N64-24187 Illinois U., Urbana
QUENCHING AND ANNEALING OF ZONE REFINED ALUMINUM
M. Doyama and J. S. Koehler Sep. 1963 46 p refs
(Contract DA-31-124-ARO(D)-65)
(TR1; AROD-3369-1; AD-437658)

When metals are quenched from a high temperature to a low temperature, most of the imperfections present in thermal equilibrium at the high temperature can be frozen in. In close-packed metals the dominant imperfections are vacancies, vacancy clusters, and dislocations arising from collapsed vacancy clusters. This research is aimed at determining the activation energy for motion of a divacancy and the binding energy of larger clusters in aluminum. The activation energy for motion of a divacancy in aluminum was interpreted to be 0.05 ±0.04 ev. The binding energy of a divacancy in aluminum was interpreted to be 0.17 ±0.05 ev. Author

N64-24209 McDonnell Aircraft Corp., St. Louis, Mo.
DETERMINATION OF CHEM-MILLING EFFECTS ON Cb-5Zr COLUMBIUM ALLOY
Robert R. Wilcox 10 Jun. 1964 6 p
(Contract AF 33(657)-11215)
(A740; AD-441118)

Results of metallographic examination of Nb-5Zr test specimens indicate that the filet and flat surface conditions of the three panels examined appear to contain the same degree of roughness. No evidence of intergranular attack was observed; however, the filets of two specimens indicated the presence of some pitting action. I.v.L.

N64-24210 McDonnell Aircraft Corp., St. Louis, Mo.
EVALUATION OF Cb-10W2.5Zr (Cb-752) COLUMBIUM ALLOY
J. P. O'Connor 10 Jun. 1964 141 p
(Contract AF 33(657)-11215)
(A742; AD-441120)

Test results are presented concerning the mechanical properties and fabricability of Cb-752 (Cb-10W-2.5Zr) sheet material. Tests were conducted at room temperature and at elevated temperatures, all in vacuum. The average room-temperature mechanical properties for all sheets combined are as follows: yield stress equals 59.7 ksi; ultimate stress equals 78.2 ksi; and elongation in 1 inch equals 25.8 percent. Approximately 30% to 35% of room-temperature strength was retained at 2,200° F and, closer to 25%, at 2,400° F. The material is apparently notch insensitive. The ultimate shear stress corresponds to about 80% of the ultimate tensile stress. The room-temperature yield and ultimate bearing stresses were 115.2 ksi and 155.0 ksi, respectively. Formability test results were very good. Cb-752 possesses good weldability. Author

N64-24219 Solar, San Diego, Calif.
EVALUATION OF RMSP TUNGSTEN SHEET Quarterly Progress Report, 1 Jan.–31 Mar. 1964
F. St. Germain and M. R. Licciardello 20 Apr. 1964 55 p refs
(Contract NOw-63-0786d)
(QPR-3; AD-437255)

The evaluation of the as-received four gages of RMSP tungsten sheets using standard acceptance test techniques was continued. Resistance heated elevated tensile tests, 5T and 6T bend-transition determinations, recrystallization measurements, and chemical analysis for carbon and columbium were performed during the reporting period. The resistance heated mechanical property evaluation for the same equivalent thicknesses showed comparative tensile properties, with lower elongations than those reported by Fansteel for the same temperature range using radiant heating test techniques. Blanking, perforating, and deep drawing investigations were conducted on each of the four tungsten sheet thicknesses. The results of the blanking and perforating studies indicate that these forming methods could be accomplished by control of sheet temperature, close tolerance tooling, and control of forming procedures. The results of the deep drawing studies indicate that successful deep recessing of thicker tungsten sheet can be obtained by stage forming at elevated temperatures with conventional tooling and control of the forming process. Author

19 MATERIALS, NONMETALLIC

Includes mechanical and physical properties of nonmetals (e.g., plastics). *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 18 Materials, Metallic; 33 Stresses and Loads; and 34 Structural Design.

N64-22952 Naval Radiological Defense Lab., San Francisco, Calif.
THE INFRARED SPECTRA OF RUBIDIUM BORATES OF VARYING COMPOSITION
J. T. Qaun and C. E. Adams 9 Dec. 1963 29 p refs
(USNRDL-TR-705; AD-430891)

The infrared transmission spectra of a series of rubidium borates consisting of varying proportions of rubidium oxide and boron oxide have been studied in the 2.5μ to 15.5μ range. The rubidium oxide concentration varied from 4.2 to 50 mole %. Frequency assignments were made for molecular groups in

these rubidium borates. The results can be interpreted to indicate that an increasing proportion of trigonally coordinated boron atoms in the borate glass network structure became tetrahedrally coordinated as the Rb_2O content was increased up to 33 mole %. This was accompanied by a simultaneous increase in the concentration of terminal $>B-O^-$ groups. Glasses containing Rb_2O in excess of 33 mole % tended to devitrify as boron reverted to trigonal coordination. At 50 mole %, the rubidium metaborate structure resembled that of sodium metaborate. Selected metal oxides, introduced into glasses of high Rb_2O content, entered into complex formation with $>B-O^-$ groups to reconstitute the network structure of the glass. Author

N64-22988 Illinois U., Urbana
ON THERMIONIC BEHAVIOR OF NON-METALS
S. L. Soo *In* Ariz. U. A Symp. on High Temp. Conversion—Heat to Elec. [1964] p 200–213 refs (See N64-22976 16-09)

The emission and ionization behaviors of a nonmetallic solid in contact with a vapor are discussed. The relation between ionization and surface charge density and application to thermionic converters are also described. Author

N64-23094 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MICROCRYSTALLINE MATERIALS ON A GLASS BASE, THEIR PROPERTIES, AND FIELD OF APPLICATION
K. T. Bondarev *In its* Problems in Development of Glass and Porcelain Ind. 28 May 1963 p 1–11 refs (See N64-23093 16-01)

The production of microcrystalline materials from glass—pyroceram—has been studied, and the processes leading to the crystallization of such materials have been discovered. Pyrocerams have been formed on fluorine glasses, light sensitive glasses, and on silicon oxide glasses with the aid of titanium oxide. Pyrocerams with a cordierite base are already in application in radio electronics and electrical engineering. It was found that a magnesium–aluminum–silicate base is also very cheap, stable at high temperatures, and mechanically strong. D.E.R.

N64-23136 Picatinny Arsenal, Dover, N.J. Plastics Technical Evaluation Center
FLUIDIZED-BED COATING WITH PLASTICS; TECHNOLOGY AND POTENTIAL FOR MILITARY APPLICATIONS
Arthur H. Landrock Jan. 1964 234 p refs
(PLASTEC 13; AD-431603) OTS: $3.50

This report on the relatively new field of fluidized-bed coating with plastics is intended to give military agencies and contractors a good idea of the possibilities and limitations of the technique. In the normal use of the process, a metal part is heated to a temperature somewhat higher than the melting point of the resin powder with which it is to be coated. Upon immersion of the preheated metal part into a bed or bath of resin powder, usually kept at room temperature and fluidized by a current of air, the powder particles are fused onto the surface of the part. Postheating may or may not be necessary to smooth and/or cure the coating. This report has detailed information on 139 references, including 39 foreign and American patents. Figures and tables are provided for many of the references. Discussions on coating resins (properties, applications, evaluation), advantages and limitations of fluidized-bed coatings, factors affecting the process, and applications are discussed. Lists of custom coaters, resin suppliers, and coating equipment suppliers are also provided. Included in this report are a number of indexes covering: subjects; personal authors; corporate authors and corporate affiliation; (military) report numbers; patents; periodicals; technical conferences. Author

N64-23137 Princeton U., N.J.
FURTHER DEVELOPMENT OF A GRAPHITE HEATER FOR HIGH PRESSURE NITROGEN OPERATION
I. E. Vas and J. K. Harvey Oct. 1963 27 p refs
(Grant AF-AFOSR-112-63)
(Rept. 669; AFOSR-5440; AD-600010)

An experimental study was conducted to extend the operation of a graphite resistance nitrogen heater to pressures above the 1,000 psi previously obtained. Using a somewhat modified design, a single-pass spiral heater element was fabricated and tested at 5,000 psi and 5,000° R. Test runs of 5 to 15 min were carried out with total operating times at elevated temperatures and pressure exceeding several hours using the same element. The temperature was determined by the mass flow technique and checked against a thermocouple installed in the stagnation chamber. Author

N64-23184 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COLLECTION OF SCIENTIFIC WORKS: CHEMISTRY AND CHEMICAL TECHNOLOGY OF SILICATE MATERIALS Selected Articles
7 Nov. 1963 117 p refs Transl. into ENGLISH of 11 Articles from Sb. Nauchn. Tr. Khim. i. Khim. Tekhnol. Silikat. Materialov (Minsk), no. 82, 1960 p 86–165
(FTD-TT-63-688/1+2+4; AD-426815)

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N64-23185 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE STUDY OF CRYSTALLIZATION IN GLASSES OBTAINED FROM LOW-MELTING CLAYS

V. N. Sharay *In its* Collection of Sci. Works: Chem. and Chem. Technol. of Silicate Mater. 7 Nov. 1963 p 1–12 refs (See N64-23184 16-19)

Work in obtaining vitreous crystalline materials is being conducted in the Soviet Union. Low-melting clay from the Moroska deposit serves as the basis for their production. The structures and mineralogical composition of the materials determine their chemical and physiochemical properties that are the bases for this study of crystallization in glasses obtained from low-melting clays. Titanium-containing clay melts are easily crystallized and acquire a vitreous crystalline structure. G.D.B.

N64-23186 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ELABORATION OF COMPOSITIONS OF LEAD-FREE CRYSTAL

L. A. Zhunina and N. N. Yermolenko *In its* Collection of Sci. Works: Chem. and Chem. Technol. of Silicate Mater. 7 Nov. 1963 p 13–20 refs (See N64-23184 16-19)

This article discusses research and development on the synthesis of new lead-free high-refracting glasses. The experimental glass was prepared on the basis of three high-refracting glass compositions. G.D.B.

N64-23187 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

USE OF LOW-MELTING CLAY IN THE PRODUCTION OF CONTAINERWARE

L. A. Zhunina, Ye. I. Mikhlyukov, and G. G. Kusonskiy *In its* Collection of Sci. Works: Chem. and Chem. Technol. of Silicate Mater. 7 Nov. 1963 p 21–34 refs (See N64-23184 16-19)

Low-melting clay may be considered as an available replacement for part of the raw materials used in the production of dark and semiwhite glass. This study is devoted to the possibility of using low-melting clays of the Moroska deposit in the production of dark bottle glass and semiwhite containerware. Two series of experimental glass were synthesized for the solution of this problem. G.D.B.

N64-23188 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE EFFECT OF INDIVIDUAL COMPONENTS AND CERTAIN ADDITIVES ON THE PROCESS OF IMPARTING A RUBY COLOR TO GLASS

G. A. Kovtunenko *In its* Collection of Sci. Works: Chem. and Chem. Technol. of Silicate Mater. 7 Nov. 1963 p 35–40 refs (see N64-23184 16-19)

The effect of individual components on the process of ruby formation can be explained by the connection between colloidal coloring and the microporous structure of glass. The greater the number and the size of cavities in glass, the more favorable the conditions for the growth of the colloidal particles of the coloring material. The effect of ions contained in the glass on disintegration and/or the strengthening of the glass lattice is the decisive factor. G.D.B.

N64-23189 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE GRAPHIC METHOD OF CONVERTING THE COMPOSITION OF GLASS FROM WEIGHT PERCENTS TO MOLAR PERCENTS AND FROM MOLAR PERCENTS TO WEIGHT PERCENTS

N. N. Yermolenko and L. N. Lambin *In its* Collection of Sci. Works: Chem. and Chem. Technol. of Silicate Mater. 7 Nov. 1963 p 41–48 refs (See N64-23184 16-19)

Simple methods for calculating the compositions of glasses and for converting molar percents into weight percents, and vice versa, are discussed. G.D.B.

N64-23190 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

USE OF THE MF-4 MICROPHOTOMETER AS A RADIATION RECEIVER IN SPECTRAL ANALYSES

A. M. Kripskiy *In its* Collection of Sci. Works: Chem. and Chem. Technol. of Silicate Mater. 7 Nov. 1963 p 49–57 refs (See N64-23184 16-19)

A simple method of investigating time changes of the intensities of individual spectral lines, groups of lines, and the entire spectrum with a time resolution of 0.3 sec by photoelectric methods are proposed. The time change of the effect of sulfur on the intensity of the spectra of Cu, Fe, Cr, Ni, and W were investigated by the proposed method. Quantitative determination of sulfur by spectral methods is recommended. G.D.B.

N64-23191 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE POSSIBILITY OF OBTAINING POROUS MATERAILS FROM VARIOUS BYELORUSSIAN CLAYS

P. F. Mikhalevich and N. K. Yagovdik *In its* Collection of Sci. Works: Chem. and Chem. Technol. of Silicate Mater. 7 Nov. 1963 p 58–74 refs (See N64-23184 16-19)

The majority of clays tested were suitable for obtaining popped ceramics with appropriate additives and with appropriate time and temperature of exposure in the furnace. Clays containing a reduced amount of SiO_2 and significant amounts of iron oxides, carbonates, and alkalies showed the best popping—a process that takes place most effectively when untreated specimens with a molding moisture are placed in the high-temperature zone. Petroleum was the best additive for most clays. G.D.B.

N64-23192 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

FACTORY TESTING OF AN EXPERIMENTAL SAGGER BODY

P. F. Mikhalevich, N. K. Yagovdik, and L. I. Rusak *In its* Collection of Sci. Works: Chem. and Chem. Technol. of Silicate Mater. 7 Nov. 1963 p 75–84 refs (See N64-23184 16-19)

The proportion of clay and grog had an insignificant effect on the quality of the specimens. Light fractions improved the characteristics of the crock. The addition of alumina had a positive effect on the mechanical and thermal resistance of the crock. When using electric stoves, adding crushed ceramics containing kaolin as a grog improved the physicomechanical properties of the saggers. G.D.B.

N64-23193 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE EFFECT OF TEMPERATURE AND RAREFACTION ON EVAPORATION DURING CASTING AND ON THE PROPERTIES OF A CERAMIC CAST
I. I. Kisel', I. M. Rybakov, and O. G. Poznyak *In its* Collection of Sci. Works: Chem. and Chem. Technol. of Silicate Mater. 7 Nov. 1963 p 85–92 refs (See N64-23184 16-19)

As the vacuum is increased and as the slip and molds are heated, the rate of cast formation is considerably increased. The methods of casting under a vacuum and when the slip and molds are heated make it possible to increase the turnover of plaster molds, and also reduce the space needed for casting. The resulting products are superior and dry faster. G.D.B.

N64-23194 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE EFFECT OF AGING AND FROST EXPOSURE ON THE CHARACTERISTICS OF BODIES AND FINISHED PRODUCTS
I. I. Kisel', K. I. Chekmareva, and I. A. Demchuk *In its* Collection of Sci. Works: Chem. and Chem. Technol. of Silicate Mater. 7 Nov. 1963 p 93–100 refs (See N64-23184 16-19)

Aging and freezing of the geological body increases the plasticity, decreases the coefficient of susceptibility and the air shrinkage, and increases the mechanical strength. A.B.

N64-23195 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE EFFECT OF ADDITIONS OF CEMENT, GYPSUM, AND ASH ON THE PHYSICOMECHANICAL PROPERTIES AND THE DRYING RATE OF CERAMIC BODIES
I. I. Kisel', V. V. Radkevich, and K. S. Shimanskiy *In its* Collection of Sci. Works: Chem. and Chem. Technol. of Silicate Mater. 7 Nov. 1963 p 101–112 refs (See N64-23184 16-19)

Adding ash, cement, and gypsum improved a number of properties of bodies and finished products by reducing the plasticity and the coefficient of susceptibility. The mechanical strength was slightly increased. The use of these additives made the products dry faster, sharply increased brick raw material, and increased frost resistance. G.D.B.

N64-23200 Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
BARRIER FILMS FOR FILAMENT-WOUND FIBERGLASS CRYOGENIC VESSELS
J. M. Toth, Jr. Aug. 1963 17 p refs Presented at the Cryog. Eng. Conf., Boulder, Colo., 21 Aug. 1963 *Its* Eng. Paper No. 1957; Paper J-5

The sealing problem in liquid hydrogen tankage is discussed. After a short period of development with a sprayed liner, it became apparent that the selection of a suitable liner was the primary problem. An integrally lined tank was decided upon. An investigation was then made of suitable liner materials. Room-temperature permeability tests were performed with a permeation cell on an unstressed flat-disc specimen. Valid data for room-temperature hydrogen permeability were obtained. Kynar was the only material to be adversely affected by an unstressed liquid-hydrogen immersion. Uniaxial cryogenic strain compatibility showed the need for strong adhesives with high elongation and the incompatibility of the considered metallic materials and fiber glass. The results of biaxial investigations are included. Glass filament stresses over 470,000 psi can be realized at −423° F. R.T.K.

N64-23247 Naval Research Lab., Washington, D. C. Chemistry Div.
FILAMENT-WINDING PLASTICS. PART I—MOLECULAR STRUCTURE AND TENSILE PROPERTIES
J. R. Griffith and F. S. Whisenhunt, Jr. 16 Mar. 1964 7 p (NRL-6047; AD-435479) OTS: $0.50

Filament winding is a process by which strands of material (glass fibers) are treated with a liquid resin and accurately placed upon a mandrel to form a structure. The resin hardens into a plastic, and the structure becomes rigid as this process occurs. Epoxide resins and aromatic diamine curing agents were used in this application. The physical properties of a filament-winding plastic are dependent upon the molecular characteristics of the resin and its curing agent. When the diglycidyl ether of bisphenol-A reacts with m-phenylene diamine, the resulting plastic strongly binds glass filaments, and good quality filament-wound objects may be produced from these materials. Author

N64-23251 Keystone Controls Corp., Newark, N.J.
CRYSTAL UNIT CR-(XM-30)/U Quarterly Progress Report, Jul.–Sep. 1963
James M. Ronan [1963] 16 p
(Contract DA-36-039-SC-85940)
(AD-436089)

Continuing efforts and disappointments in attempting to obtain satisfactory glass holder parts are detailed, as well as efforts to improve the glass sealing equipment and proving of crystal design. Author

N64-23290 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CRYSTALLINE STRUCTURE OF THE NEW CLOSE-GRAINED MODIFICATION OF SILICA, SiO_2
S. M. Stishov and N. V. Belov 13 Feb. 1963 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 143, no. 4, 1962 p 951–954
(FTD-TT-62-1709/1+2; AD-401734)

A powder pattern of SiO_2 was obtained. The angles of reflection, the interplane distances, and the intensities of the new close-grained modification of SiO_2 are presented in tabular form. A structure diagram (obtained by using an axometer) of the new modification of SiO_2 is included. R.T.K.

N64-23297 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METHOD OF OBTAINING THERMOSTABLE TRIAZINE RUBBER
M. P. Krasuskaya and I. L. Knunyants 14 Mar. 1963 4 p Transl. into ENGLISH from Soviet Patent No. 145748, 25 May 1961 p 1–2
(FTD-TT-63-176/1; AD-401598)

A method for obtaining thermostable triazine rubber is described that is based on the copolycondensation of diamidines of high perfluoro-dicarboxylic acids (e.g., perfluoro sebacic and perfluorododecamethylenedicarboxylic acids), and monoamidines of fluoro-containing acids (e.g., 2,6-dichloroperfluorocaproic acid). The triazine rubber obtained by the described method possesses high thermostability (up to 450° to 480° C) in combination with high elasticity and chemical stability with respect to concentrated acids and organic solvents. J.L.D.

N64-23298 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
GLASSY STATE (SELECTED ARTICLES)
6 May 1963 51 p refs Transl. into ENGLISH from the book "Stekloobraznoye Sostoyanie" Moscow, Izd. Akad. Nauk SSSR, 1960 p 115–119, 177–194, 360–365, 387–391
(FTD-TT-63-265/1+2+4; AD-409701)

CONTENTS:

1. FORMATION OF THE CRYSTAL PHASE FROM A SILICATE FUSION A. I. Avgustinik p 1–7 refs
2. INFRARED REFLECTION SPECTRA OF SODIUM-SILICATE GLASS, AND THEIR CONNECTION WITH STRUCTURE p 8–29 refs
3. EFFECT OF GLASS STRUCTURE ON SPECTRAL AND CHEMICAL PROPERTIES OF CERIUM IONS G. O. Karapetyan p 30–40 refs
4. ELASTIC PROPERTIES OF GLASS AS A FUNCTION OF TEMPERATURE Y. I. Kozlovskaya p 41–48 refs

N64-23300 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FIBROUS CARBON
V. Yu. Nikolayev and V. I. Kasatochkin 10 May 1963 24 p refs Transl. into ENGLISH from Tr. Inst. Goryuch Iskop., Izd. Akad. Nauk SSSR, v. VIII, 1962 p 135–148
(FTD-TT-63-330/1+2+4; AD-410074)

During the slow pyrolysis of carbon-containing gases, elastic fibrous forms of carbon and graphitic fibers form on the walls of the reaction spaces. Fibrous carbon is very promising as a heat-insulating and filtering material in corrosive media; for an inert and reduction atmosphere, it can be used up to a temperature of 2,760° C. Methods of obtaining fibrous carbon, as well as its uses, are described. G.D.B.

N64-23331 California U., Berkeley. Lawrence Radiation Lab.
REDUCTION USING SOLUTIONS OF CALCIUM IN MOLTEN SALTS
H. Bloom Dec. 1963 10 p refs
(Contract W-7405-ENG-48)
(UCRL-11205) OTS: $0.50

A method is given whereby hydrogen is used in the presence of calcium dissolved in calcium iodide–potassium iodide eutectic as reducing agent, with helium as the carrier gas. G.D.B.

N64-23406 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE NEW ERA FOR PORCELAIN
Cheg Chih-Chiang 8 Mar. 1963 10 p Transl. into ENGLISH from K'o Hsueh Ta Chung (China), no. 4, 1962 p 99–100
(FTD-TT-62-1664/1+2; AD-401468)

An experimental beryllium oxide porcelain with a nonbubble reflective seal is described that will soften under high temperature but will not disintegrate. The properties of materials made by combining ceramics and metals are discussed. R.T.K.

N64-23407 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SYSTEMS WITH BERYLLIUM OXIDE AND THEIR USE IN TECHNOLOGY
P. P. Budnikov and R. A. Belyayev 13 Mar. 1963 19 p refs Transl. into ENGLISH from Zh. Vses. Khim. Obshchestva im. D. I. Mendeleeva (USSR), v. 6, no. 6, 1961 p 629–635
(FTD-TT-62-1712/1+2; AD-299870)

Discussed are the remarkable properties of beryllium oxide—high-heat resistance, favorable nuclear properties, excellent resistance to thermal impact, considerable chemical inertness at high temperatures, low vapor pressure, heat conduction, etc. Its employment in metallurgy, atomic energy, vacuum technology, and other fields of science and technology is thus assured. Some of these uses of beryllium oxide systems are considered. G.D.B.

N64-23446 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SYNTHESIS OF CESIUM OZONIDE THROUGH CESIUM SUPEROXIDE
I. I. Bol'nov and V. V. Matveyev 25 Mar. 1964 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Khim. Nauk (Moscow), no. 6, 1963 p 1136–1139
(FTD-TT-64-194/1+2+4; AD-435995)

Cesium ozonide of high purity was obtained by a reaction between cesium superoxide and ion ozonized oxygen. By a method of differential thermoanalysis, the behavior of cesium ozonide upon heating was studied, and the limit of its thermostability was accurately established. P.V.E.

N64-23452 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
POLYESTER PREMIXES
B. Schreiber *In its* Machine Eng. 28 Sep. 1962 p 1–16 (See N64-23451 16-01)

A study is made of the production of polyester premixes to determine the useful application of these materials. The principal properties of premixes are explained, and their properties are compared with those of conventional molding materials. J.R.C.

N64-23507 Joint Publications Research Service, Washington, D.C.
PROBLEMS OF INVESTMENT AND CHILL CASTING
17 Jun. 1964 24 p refs Transl. into ENGLISH from Liteynoe Proizv. (Moscow), no. 1, Jan. 1964 p 2–5, 42–44
(JPRS-25135; OTS-64-31512) OTS: $0.75

CONTENTS:

1. PROBLEMS IN THE MANUFACTURE OF AN ETHYL-SILICATE COVERING FOR INVESTMENT CASTING Z. K. Ancheeva, M. H. Yefimov, L. A. Zhitkova, B. A. Pepelin, and M. V. Raxumkova p 1–15 refs (See N64-23508 16-19)
2. BASICS OF INVESTMENT CASTING A. A. Tager, S. V. Myshalov, and G. S. Krasnova p 16–19 refs (See N64-23509 16-19)
3. CHILL MOLD CASTING OF IMPELLERS WITH THE USE OF CERAMIC CORES S. M. Goldreer, M. P. Fedorov, and V. Ye. Novikov p 20–22 refs (See N64-23510 16-19)

N64-23508 Joint Publications Research Service, Washington, D.C.
PROBLEMS IN THE MANUFACTURE OF AN ETHYL-SILICATE COVERING FOR INVESTMENT CASTING

Z. K. Ancheeva, M. H. Yefimov, L. A. Zhitkova, B. A. Pepelin, and M. V. Razumkova *In its* Probl. of Investment and Chill Casting 17 Jun. 1964 p 1–15 (See N64-23507 16-19) OTS: $0.75

Comparative tests were conducted on the durability of ceramic samples; the hydrolyzed solutions were prepared by the combined method to evaluate the possibility of using such a method in effective production. The greatest durability of samples was obtained with the combined method of preparing suspensions in all tests and for any relationship of components. G.D.B.

N64-23509 Joint Publications Research Service, Washington, D.C.
BASICS OF INVESTMENT CASTING
A. A. Tager, S. V. Myshalov, and G. S. Krasnova *In its* Probl. of Investment and Chill Casting 17 Jun. 1964 p 16–19 refs (See N64-23507 16-19) OTS: $0.75

The results of this work evaluated the degree of polycondensation of ethylsilicate by measuring the viscosity—a simpler and more convenient method than determining the SiO_2. It is recommended that the index of viscosity be included in the conditions for ethylsilicate, and that various products be characterized, not by percentage of silicon but by definite indices of viscosity expressed in poises. G.D.B.

N64-23510 Joint Publications Research Service, Washington, D.C.
CHILL MOLD CASTING OF IMPELLERS WITH THE USE OF CERAMIC CORES
S. M. Goldreer, M. P. Fedorov, and V. Ye. Novikov *In its* Probl. of Investment and Chill Casting 17 Jun. 1964 p 20–22 (See N64-23507 16-19) OTS: $0.75

In casting impellers with a diameter of 150 to 200 mm, and with a fin height of 4 ± 0.4 mm by investment patterns, the yield of suitable impellers did not exceed 15% to 20%, because of the difficulty of coloring the interior cavities of the models and the impossibility of determining the quality of paint until the forms are filled. The impellers were therefore cast in a chill mold with ceramic cores. In this way, a core box and press form were used during both investment casting and chill molding. G.D.B.

N64-23521* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Electromechanical Div.
CO_2 REDUCTION UNIT DESIGNED FOR CONTINUOUS ZERO GRAVITY OPERATION Interim Report
20 Nov. 1963 46 p refs
(Contract NASw-650)
(NASA-CR-56544; ER-5670) OTS: $4.60 ph

A carbon dioxide reduction unit has been designed and fabricated. Carbon dioxide is reduced by hydrogen to carbon and water, using flat iron plates as the catalyst. Carbon and water are continuously removed from the reaction gases. Product water is electrolized to oxygen and hydrogen. All components have been designed for operation in a zero-gravity environment. Preliminary tests on the one-half man capacity unit were carried out at a system pressure of 2 psig. Reaction rates up to 900 cc/min of reaction gases were obtained at a reactor temperature of 1,110° F. Carbon was successfully removed from the reactor during operation of the system.
Author

N64-23709 Air Force Systems Command, Wright-Patterson AFB, Ohio
GELATIN, A RIGIDIZING MATERIAL FOR AEROSPACE STRUCTURES
F. W. Forbes, S. Allinikov, and C. Koons *In its* Aerospace Expandable Struct. Mar. 1964 p 192–215 (See N64-23701 16-03)

A study is made of gelatin as a rigidizing material for aerospace structures. Gelatin is of interest as a possible rigidizing material because it exhibits potentially high tensile and modulus of elasticity values as well as a high resistance to ultraviolet radiation. J.R.C.

N64-23710 National Cash Register Co., Dayton, Ohio
MICRO ENCAPSULATED POLYURETHANE FOAM REACTANTS FOR AEROSPACE STRUCTURES
Robert E. Kass and Lawrence R. Lankston *In* AFSC Aerospace Expandable Struct. (See N64-23701 16-03)
(Contract AF 33(657)-8961)

The concept of encapsulating the reactive constituents of a foam formulation has been developed and proven feasible. Rigid polyurethane foams have been produced in a vacuum as high as 10^{-6} torr; these foams are especially formulated for high-vacuum applications. Standard atmospheric formulations will not produce satisfactory foams when reacted in a high vacuum. The encapsulation technique allows premixing and storage of the formulation at room temperatures for long periods of time. In order to reduce the orange peel effect of the foam on Mylar and to reduce the creep of Mylar, a backcoating is being developed. The present coating is rather thick, but it is anticipated that future coatings may be less than 0.005 in. thick. Author

N64-23711 Air Force Systems Command, Wright-Patterson AFB, Ohio Materials Lab.
RIGIDIZATION OF EXPANDABLE STRUCTURES VIA GAS CATALYSIS
T. L. Graham and R. G. Spain *In its* Aerospace Expandable Struct. Mar. 1964 p 236–254 ref (See N64-23701 16-03)

A study is made of rigidizing expandable structures via gas catalysis. While the various gas catalyzed rigidization systems are dependent upon temperature as to the rate of the rigidization reactions, no high-threshold temperatures are involved. Structures based on this concept of rigidization are comprised of the following components: (1) a high-strength fabric polymer serving as the cover; and (2) the ply or plies of reinforcing fabric that are impregnated with the rigidizable resin. J.R.C.

N64-23717* Hughes Aircraft Co., Culver City, Calif. Materials Technology Dept.
ULTRAVIOLET AND HEAT RIGIDIZATION OF INFLATABLE SPACE STRUCTURES
S. Schwartz, R. W. Jones, and L. B. Keller *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 369–380 refs (See N64-23701 16-01)
(Contract NAS1-847)

It is proved that Mylar film laminates can be rigidized by using energy sources available in outer space. The study shows that both infrared radiation and ultraviolet radiation are practical methods for rigidizing inflatable space structures. J.R.C.

N64-23721 Goodyear Aerospace Corp., Akron, Ohio
MECHANICALLY MIXED POLYURETHANE FOAM-RIGIDIZED SOLAR COLLECTORS
L. Manning *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 432–460 refs (See N64-23701 16-01)
(Contract AF 33(657)-10165)

A discussion is presented on a mechanically mixed polyurethane foam-rigidized solar collector. The polyurethane

chemicals start out as a pair of viscous fluids that present very little resistance to the gas-pressure forces involved. During the jelling process, the foam cell size increases as the gas expands, more CO_2 is produced, and some cells coalesce when their intercell walls become thin and break through. If rigidization occurs before the foam has collapsed from excessive bubble sizes, a foam is successfully achieved. J.R.C.

N64-23722 Hughes Aircraft Co., Culver City, Calif. Materials Technology Dept.
DEVELOPMENT OF A ONE PART "FOAM-IN-SPACE" POLYURETHANE
Seymour Schwartz *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 461–477 (See N64-23701 16-01)
(Sponsored by AF)

It is concluded that there are a number of approaches that might be used to produce polyurethane foams in a vacuum environment. These include the solid reactants, encapsulated components, absorbed catalyst–water systems, and possibly blocked isocyanates. The one part, solid-reactant heat-triggered material is considered to possess many characteristics that make it ideal for space usage, in addition to the obvious advantage of elimination of the metering and mixing processes. The vacuum environment is used to assist in the flowing process. The powder may be very simply packaged, with no need for vapor flight-pressure-resistance containers and refrigeration. J.R.C.

N64-23723* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MECHANICAL PROPERTIES OF COMPOSITE MATERIALS FOR EXPANDABLE SPACE STRUCTURES
Howard L. Price *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 478–500 refs Presented at the Conf. on Aerospace Expandable Structures, Dayton, Ohio, 22–24 Oct. 1963 (See N64-23701 16-01)

An analysis is presented of tests to determine the mechanical properties of several composite materials that are used or have potential use in aerospace structures. The composites are approximately 0.001 in. thick, and are laminates of aluminum foil and Mylar film, aluminum foil and polypropylene film, and vapor-deposited aluminum on Mylar film. The analysis is made on the basis of tensile stress-strain, stress-relaxation, and flexural-stiffness tests. The stress-strain and stress-relaxation tests illustrate the mechanical behavior of the composites as influenced by their composition. A comparison is made of the flexural rigidity of the composites as measured by the heavy elastica method. Author

N64-23733* Radiation Applications, Inc., Long Island City, N.Y.
STUDY OF THE MEMORY EFFECT OF POLYETHYLENE FOR SPACE EXPANDABLE STRUCTURE APPLICATIONS
George Odian and Bruce S. Bernstein *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 702–714 refs (See N64-23701 16-01)
(Contract NASr-78)

The memory effect of irradiated polymers involves the ability of a formed object to return to its original shape merely by heating, after it has been heated above ambient, deformed, and cooled in the deformed shape. This novel phenomenon has high potential utility in space expandable applications. The parameters controlling the minimum restoration temperature, degree of restoration, and restoring force were studied with consideration of the technique for expansion of objects in space. Polyethylene was studied, although the process is applicable to many polymers. The minimum restoration temperature is controlled by the inherent polymer composition and nature. The degree of restoration is controlled by the restoration temperature and by the deformation conditions. The restoring force is controlled by the deformation conditions and the radiation dose. Author

N64-23979 Naval Ordnance Lab., White Oak, Md.
LAMINATE STRENGTH CHANGES AFTER TEN-YEARS AGING
P. W. Erickson Jun. 1964 20 p ref
(NOLTR-64-1; AD-601591)

This report contains flexural strength data showing the effects of 10-year aging on epoxy and polyester laminates. Small reductions in strength were noted in 18 of the 20 cases where comparisons could be made. Epoxy and polyester laminates maintained their strength properties equally well. Modulus values for the epoxy laminates were reduced in all but one case in amounts from 5% to 16%. The aging effect on the modulus of polyester laminates, on the contrary, was to increase the values from 3% to 13%. Author

N64-23983 Prodesco, Inc., Perkasie, Pa.
DEVELOPMENT OF COTTON AND NYLON, KNITTED CLOTH WITH ELASTIC STRETCH CHARACTERISTICS
Hal E. Brockmann Wright-Patterson AFB, Ohio, Systems Eng. Group, May 1964 12 p
(Contract AF 33(657)-9510)
(SEG-TDR-64-6; AD-601831)

Blends of cotton and synthetic fibers were studied (nylon, polyester). These were knitted into fabrics to evaluate their elastic elongation, gripping characteristics, and nonyellowing properties (in the case of white). Data are presented on the yarns and fabrics employed. The fabric was designed to provide a clean, snug fitting glove that has good gripping characteristics equal to all cotton. Author

N64-23987* IIT Research Inst., Chicago, Ill.
INVESTIGATION OF LIGHT SCATTERING IN HIGHLY REFLECTING PIGMENTED COATINGS Quarterly Report, Jan. 1–Apr. 1, 1964
G. A. Zerlaut, V. Raziunas, S. Katz, and B. Kaye 5 May 1964 52 p
(Contract NASr-65(07))
(NASA-CR-56307; IITRI-C6018-8) OTS: $5.60

The preparation and measurement of the optical properties of both monomodal and bimodal dispersions of silver bromide in liquid and gelatin suspensions are reported. Scattering extrema as manifested in transmittance spectra were measured. The scattering extrema were determined as a function of gelatin film thickness. The transmittance of mixtures of two size distributions, to give a bimodal particle distribution, were determined. Multipole interactions, resulting in fine structure in the transmittance measurements, were observed on liquid suspensions of 1.3μ polystyrene spheres. Author

N64-24015* Telecomputing Corp., San Diego, Calif. Narmco Research and Development Div.
ELASTOMERIC GASKET MATERIALS DEVELOPMENT FOR CRYOGENIC APPLICATIONS Quarterly Summary Report, No. 4, 1 Aug.–31 Oct. 1963

Jay W. Feldmann 15 Nov. 1963 18 p
(Contract NAS8-5053)
(NASA-CR-56648) OTS: $1.60 ph

A second, fabric square analysis revealed the relative importance of the parameters to be fabric weave, fabric style, and laminating temperature, respectively. Optimum values were Crowfoot weave, 225-yard type, and 700° F, respectively. The analysis was carried out to implement the development of new flat gasket materials suitable for use in the liquid-oxygen system of the Saturn launch vehicle. Metal-reinforced laminates were fabricated and tested. Encapsulation of gaskets using Teflon–glass was started. G.D.B.

N64-24052* Michigan U., Ann Arbor High Altitude Engineering Lab.
REFLECTANCE OF KODAK WHITE PAPER
F. L. Bartman, L. W. Chaney, and M. T. Surh Apr. 1964 26 p refs
(Contract NASr-54(03); ORA Proj. 05863)
(NASA-CR-56456; Rept.-05863-5-7) OTS: $2.60 ph

Data on the spectral directional reflectance and spectral bidirectional reflectance of Kodak white paper (double weight photographic stock) are presented and discussed. It is concluded that Kodak white paper does not have perfectly diffuse (Lambertian) reflectance and that, under certain conditions of use, large errors might result from this assumption. Definitions of spectral and total directional and bidirectional reflection are presented. Data on the reflectance characteristics of magnesium oxide are presented. Author

N64-24084* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORIGIN OF DIAMONDS IN THE UREILITES
Michael E. Lipschutz Repr. from Sci., v. 143, no. 3613, 27 Mar. 1964 p 1431–1434
(NASA-RP-204)

Diamonds in two of the three diamantiferous stony meteorites (ureilites) show a pronounced crystallographic orientation. This suggests that the diamonds were produced by shock during breakup of the meteorite's parent body rather than by high gravitational pressure. Author

N64-24094 Edgerton, Germeshausen and Grier, Inc., Boston, Mass.
DEVELOPMENT OF A SUPER POWER DEUTERIUM THYRATRON Third Quarterly Report, 13 Dec. 1963–13 Mar. 1964
Nicholas Reinhardt 13 Apr. 1964 9 p
(Contract NObsr-89405)
(B-2789; AD-436758)

Five prototype superpower deuterium thyratrons were evaluated. Two of the tubes constructed previously were evaluated during the current period. Three were fabricated and evaluated in this reporting period. The basic design of the tube appeared to be satisfactory and was not changed. However, since tubes with satisfactory characteristics throughout life were not obtained consistently, some modifications were made in the fabrication techniques and in the processing schedules. The fabrication and testing of the tubes are described, and the conclusions and recommendations based on the tests are presented. R.T.K.

N64-24112* General Electric Co., Philadelphia, Pa. Missile and Space Div.
THE SYNTHESIS OF BORON CARBIDE FILAMENTS Third Quarterly Report
A. Gatti, R. Cree, E. Feingold, and R. Mehan 10 Apr. 1964 31 p refs
(Contract NASw-670)
(NASA-CR-56230) OTS: $3.60 ph

B_4C filaments were grown, and progress was made toward ascertaining their strength and crystal structure. Continued improvement was made in the length and number of whiskers that can be produced using the pure vapor method. Whiskers, whose lengths approach 8mm, were grown reproducibly. Although whisker-like crystals can be produced by the dynamic flow method, they do not compare in quality and quantity with the whiskers grown by the pure vapor method. The dynamic method will not be abandoned completely until all avenues of research have been investigated. Strength data have been accumulating, and although testing of the filaments is a difficult task because of their length, significant progress was made. Some wetting studies were made in a preliminary attempt to choose a suitable matrix for composite fabrication. Author

N64-24130 France Ministere de L'Air, Paris
STRUCTURE OF POLYMERS OF DIALLYLIC PHTHALATES BY INFRARED SPECTROMETRY [STRUCTURE DES POLYMERES DES PHTHALATES DIALLYLIQUES PAR SPECTROMETRIE INFRAROUGE]
Francois Lalau-Keraly Paris, Service de Documentation Sci. et Tech. de L'Armement, 1964 65 p refs *Its* Publ. Sci. et Tech., no. NT-134 In FRENCH

Polymers of diallyl phthalates have been prepared at different temperatures from different concentrations of peroxide of benzoyl, tertiary butyl perbenzoate, and tertiary dibutyl peroxide. The degree of unsaturation of the polymers thus prepared was determined by infrared spectrophotometry and verified by the Wijs method. The infrared method was found to be superior to the chemical method because it permits the study of insoluble and nonfusable polymers. Trans. by M.P.G.

N64-24138 National Bureau of Standards, Boulder, Colo.
DESIGN OF STATIC ELASTOMERIC SEALS FOR CRYOGENIC TEMPERATURES
D. H. Weitzel, P. R. Ludtke, and R. F. Robbins [1964] 27 p refs Presented at the Leak-tight Separable Fluid Connector Design Conf., NASA, Marshall Space Flight Center, Huntsville, Ala., 24–25 Mar. 1964
(R-320) NBS: $1.50

The use of elastomeric O-rings for static seals that are cooled to cryogenic temperatures is discussed. Experiments developing principles to be followed and materials to be used in the design of this type of seal are reviewed. Several designs that incorporate the advantages of spring loading and pressure actuation are suggested. It is conclusively shown that elastomers should not be overlooked when considering the problem of leak tight fluid connectors for service at cryogenic temperatures. Author

N64-24145 National Bureau of Standards, Washington, D.C.
ON THE CONCENTRATIONS OF VIBRATIONALLY EXCITED O_2 FORMED IN THE FLASH PHOTOLYSIS OF NO_2
Arnold M. Bass and David Garvin Repr. from J. of Chem. Phys., V. 40, no. 6, 15 Mar. 1964 p 1772–1773
(NASA Order R-64)

This is a study of a flash photolytic reaction, from which conclusions were reached that differ markedly from those of Kane *et al* on the vibrational energy distribution of oxygen molecules formed in the reaction of oxygen with NO_2, followed by the above reaction. G.D.B.

N64-24152 Olin Mathieson Chemical Corp., New Haven, Conn. Organics Div.
DEVELOPMENT OF NONFLAMMABLE HYDRAULIC FLUIDS AND LUBRICANTS Bimonthly Progress Report, 18 Feb.–17 Apr. 1964
E. H. Kober, H. F. Lederle, and G. F. Ottmann 27 Apr. 1964 48 p refs
(Contract NObs-90092)
(BMPR-3; AD-437355)

Additional trimeric and tetrameric mixed substituted (aryl-1, 1-di H-polyfluoroalkyl)phosphonitrilates were prepared and evaluated. Of these, trimeric (m-ethylphenyl-1,1-di H-trifluoroethyl)phosphonitrilate had the lowest density(1.33) and tetrameric (m-fluorophenyl-1, 1-di H-heptafluorobutyl) phosphonitrilate, the lowest pour point (−45° F) obtained so far in this class of compounds. Trimeric bis(p-methoxyphenyl) phosphonitrilate and trimeric bis(p-nitrophenyl) phosphonitrilate have been prepared as intermediates for potentially water soluble or emulsifiable products. Two members of a new class of fluids, the trimeric and tetrameric mixed substituted (arylamino-polyfluoroalkoxy) phosphonitriles have been prepared and evaluated. Author

N64-24184 Union Carbide Corp., Lawrenceburg, Tenn. Advanced Materials Lab.
RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. VOLUME XXXVIII. DEVELOPMENT OF AN IMPROVED LARGE-DIAMETER ULTRAFINE-GRAIN GRAPHITE Technical Documentary Report, Sep. 1961–Dec. 1962
R. A. Howard and R. L. Racicot Wright-Patterson AFB, Ohio, AF Materials Lab., Apr. 1964 27 p refs
(Contract AF 33(616)-6915)
(WADD-TR-61-72; AD-601406)

This report describes the development, fabrication processes, and physical properties of grade RVD graphite (formerly RT-0008), 18-in. diam by 15-in length, and an attempted scale-up of this grade to 33-in. diam. Grade RVD graphite, an extra-fine-grain material formed by pressure curing, is nominally characterized by a density of 1.87 to 1.89 g/cc and flexural strengths of 4,700 lb/in^2 with the grain and 3,100 lb/in^2 across the grain. Nozzles made from RVD graphite, tested in a subscale rocket motor, exhibit a low erosion rate and high thermal shock resistance. Author

N64-24211 McDonnell Aircraft Corp., St. Louis, Mo.
DETERMINATION OF THE SUITABILITY OF THE EPOXY POLYAMIDE PAINT SYSTEM
10 Jun. 1964 26 p
(Contract AF 33(657)-11215)
(A757; AD-441135)

Two epoxy polyamide paint systems were modified and tested. The two paint systems were evaluated with respect to drying times, wet-tape adhesion, and hot-air blast resistance. Both AMP P-149 acrylic modified epoxy polyamide topcoat and DMP-30 modified MIL-C-22750 epoxy polyamide topcoat were tested over the MIL-P-23377 epoxy polyamide primer. The MMS-405 insignia white epoxy system that is currently used in production was also tested (drying times only) as a control. Test results indicated that neither the AMP P-149 acrylic modified epoxy polyamide nor the DMP-30 modified MIL-C-22750 epoxy polyamide system is equivalent to the MMS-405 epoxy system in either speed of drying, wet-tape adhesion to contaminated panels, or hot-air blast resistance. The only significant differences between the two AML systems was that the DMP-30 modified system had slightly better hot-air blast resistance than the acrylic modified system, and that the DMP-30 modified system had better adhesion to hydraulic fluid contaminated panels. Author

N64-24212 Telecomputing Corp., San Diego, Calif. Narmco Research and Development
DETERMINATION OF THE PERFORMANCE OF PLASTIC LAMINATES AT CRYOGENIC TEMPERATURES Technical Documentary Report, 15 Nov. 1962–15 Feb. 1964
Don W. Chamberlain, B. R. Lloyd, and R. L. Tennent Wright-Patterson AFB, Ohio, AF Mater. Lab., Mar. 1964 95 p ref
(Contract AF 33(616)-8289)
(ASD-TDR-62-794, Pt. II; AD-288944)

This program is a continuation of the effort for the determination of mechanical properties of various plastic laminate materials at cryogenic temperatures. This portion of the program was extended to include additional resin systems, some of which have been developed specifically for cryogenic applications. Also investigated were additional reinforcement materials, including stainless steel, nylon, and Fortisan. Mechanical-properties data included tensile, compressive, and flexural strength, and modulus of elasticity, as well as bearing strength and tensile fatigue values. Test temperatures used were room temperature, −110°, −320°, and −423° F. Results of this program show several glass-reinforced plastic laminate materials to be most promising as structural materials for use in cryogenic environments. Author

20 MATHEMATICS

Includes calculation methods and theory; computers; data processing; and numerical analysis. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; and 22 Navigation and Guidance.

N64-22799 Weston Hydraulics, Ltd., Van Nuys, Calif.
DIGITAL AND ANALOG ACTUATION SYSTEMS POWER CONSUMPTION COMPARISONS
Kan Ramchandani [1964] 36 p refs Presented at the SAE Meeting A-6, Subcommittee A-6D, Phoenix, Ariz. 14 Apr. 1964
(Rept-747)

This paper presents means for computation of power requirements of digital and analog systems, comparison of their relative efficiencies, time response, and general performance. The basic study shows a digital system desirable for step inputs and for positioning against fluctuating loads. The system under these conditions demands bursts of energy from the power supply and reaches the desired position in a very short time. In moving from point to point a digital system uses greater levels of energy for shorter periods of time, resulting in a smaller product of total energy and response time. For slow time varying inputs a digital system tends to ask for more fluid power from the source. A system for comparison and analysis has been assumed that is based on a known flight-control system now in use. Author

N64-22836 IIT Research Inst., Annapolis, Md. Electromagnetic Compatibility Analysis Center
AUTOMATIC TERRAIN INFORMATION PROCESSING SYSTEM

J. Iseli. *In* IIT Res. Inst., Ninth Tri-Serv. Conf. on Electromagnetic Compatibility Oct. 1963 p 493-504 (See N64-22809 16-09)
(Contract AF 19(604)-8440)

As an integral part of an operational problem solving capability, a data-processing system for the UNIVAC 1107 that will provide automated terrain information processing capabilities was created. These capabilities include the ability to create, maintain, compress, and retrieve from a multireel, random access, variable spaced, terrain elevation information file; the ability to automatically generate terrain profiles between pairs of specified points, where elevation data points occur at discrete distances ranging from approximately every 100 ft to every 3,000 ft; the ability to automatically calculate terrain profile characteristics parameters required in propagation analysis; and the ability to generate visual terrain profile displays. Author

N64-22909 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
ON THE PROBLEM OF (P, Q) ANALYTIC FUNCTIONS OF A COMPLEX VARIABLE AND THEIR APPLICATIONS
G. N. Polozhiy 8 May 1964 50 p refs Transl. into ENGLISH from Rev. de Math., Pures et Appl., (France), v. 2, 1957 p 331-361
(RSIC-172; AD-600686)

This report deals with the following: (1) three classes of generalized analytic functions; (2) the simplest properties of p-analytic and (p, q)-analytic functions; (3) differentiation and integration of p-analytic functions with regard to conjugate variables; (4) differential equations and elementary functions in the simplest class of p-analytic functions; (5) differentiation and integration with regard to conjugate variables of (p, q)-analytic functions; (6) generalized analytic functions of a third class; (7) the applications of p-analytic functions to an axisymmetric theory of elasticity; and (8) the application of (p, q)-analytic functions to the theory of torsional shafts with variable sections and with axisymmetrical filtration—method of major regions. I.v.L.

N64-22951 Naval Ordnance Lab., White Oak, Md.
ANALYTIC SOLUTIONS TO THE EQUATIONS OF MOTION OF MISSILES HAVING SIX DEGREES OF FREEDOM
W. E. De Grafft May 1964 71 p refs Previously Published as N64-15645 07-23
(NOLTR-63-241; Aerodynamics Res. Rept.-215)

Approximate analytic solutions to the six-degree-of-freedom equations of motion for vehicles experiencing arbitrary changes in flight speed, spin rate, and atmospheric density are presented. These solutions are applicable to vehicles having a constant and symmetrical mass distribution about the longitudinal vehicle axis and constant linear aerodynamic coefficients. The solution of the equation of angular motion is epicyclic as in the case where the flight speed, spin rate, and atmospheric density are constant. The stability criteria show that an acceleration in spin rate has a stabilizing effect on the nutational mode and a destabilizing effect on the precessional mode. An increase in the static margin decreases the effects of spin-rate accelerations on the natural modes of oscillation. The angular motions of several vehicles flying at a constant altitude and flight speed but accelerating in spin rate were studied. Calculations of the amplitudes and frequencies of the natural modes of motion, using the approximate solutions, are compared to results obtained from a six-degree-of-freedom computer program. Author

N64-22960 Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.
A PROCEDURE FOR CALCULATING THE BESSEL FUNCTIONS $J_\nu(x)$
Edward W. Ross, Jr. Mar. 1964 23 p refs
(AMRA-TR-64-06; AD-600111)

A procedure is studied for calculating the Bessel functions $J_\nu(x)$ (ν real and nonnegative) by utilizing their expansion in Laguerre polynomials. The errors, as estimated by the first neglected terms, are compared with the errors in the usual Bessel expansion for moderate x-values and are found to be more nearly uniform. The procedure appears to have some advantages over those now in use. Author

N64-23047* National Aeronautics and Space Administration, Washington, D.C.
APACHE SUB-ROUTINE FOR THE AUTOMATIC INTRODUCTION OF FIXED AND VARIABLE DELAY FUNCTIONS IN ANALOG PROBLEMS [SOUS-ROUTINE APACHE POUR L'INTRODUCTION AUTOMATIQUE DES FONCTIONS-RETARD FIXES ET VARIABLES DANS LES PROBLEMES ANALOGIQUES]
J. Gamp Jun. 1964 73 p refs Transl. into ENGLISH Previously Published in FRENCH as EUR-347.f; see N63-23192 24-23
(EUR-347.f)

Of the approximations that may be used to represent the delay function, that of Padé is most accurate and permits a simple extension to high orders. The APACHE code permits a systematic method of scaling and also a subroutine that calculates the coefficients and static check values for any order from 2 to 20, and for any input. The delay may be fixed or variable. Author

N64-23105 Wisconsin U., Madison Mathematics Research Center
CASCADED COUNTERS WITH FEEDBACK
Michael Yoeli Mar. 1964 7 p refs
(Contract DA-11-022-ORD-2059)
(MRC-467; AD-437287)

A general formula for the count of cascaded counters with feedback is derived. The result is obtained by the application of signal flow graph techniques to directed graphs labeled by elements of an associative semiring. Author

N64-23107 Aerospace Research Labs., Wright-Patterson AFB, Ohio Applied Mathematics Research Lab.
EXPECTED VALUES OF EXPONENTIAL, WEIBULL, AND GAMMA ORDER STATISTICS
H. Leon Harter Feb. 1964 113 p refs
(ARL-64-31; AD-436763)

Five-decimal-place tables, accurate to within a unit in the last place, are given of the expected values of the Mth order statistics [M = 1(1)N] of samples of size N from the exponential population [N = 1(1)120] and from the Weibull and gamma populations [N = 1(1)40]. In each case, the values of the location and scale parameters are assumed to be 0 and 1, respectively. Results are tabulated for the Weibull population with shape parameter K = 0.5(0.5)4(1)8 and for the gamma population with shape parameter α = 0.5(0.5)4, as well as for the exponential population, which is a special case (shape parameter 1) of each of the other two populations. Also given is an eight-decimal-place table, accurate to within a unit in the last place, of the moments (mean, variance, skewness, and kurtosis) of the exponential population and of the Weibull and gamma populations with the above-mentioned

values of the shape parameters. The mathematical formulations are given, along with a description of the methods of computation and a discussion of uses of the tables. Author

N64-23123* National Aeronautics and Space Administration, Washington, D.C.
THE TWO-DIMENSIONAL PROBLEM OF RECONSTRUCTING THE TRUE LUMINANCE INDICATRIX FROM THE MEASURED SMOOTHED CURVE [DVUMERNAYA ZADACHA VOSSTANOVLENIYA ISTINNOY INDIKATRISY YARKOSTI PO IZMERENNOY SGLAZHENNOY]
A. A. Dmitriyev Nov. 1964 10 p ref Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, Sep.–Oct. 1963 p 221–226
(NASA-TT-F-8813)

The one-dimensional case considered previously by others is generalized to the two-dimensional field. It is possible to reconstruct the true luminance from smooth measurements where there is a rectangular distribution of instrument sensitivity over a given solid-angle interval and where the sensitivity falls off from the sighting point. N.E.A.

N64-23198 Travelers Research Center, Inc., Hartford, Conn.
REGRESSION ESTIMATION OF EVENT PROBABILITIES
Robert G. Miller Apr. 1964 158 p refs
(Contract CwB-10704)
(TR-1)

The MDA (multiple discriminant analysis) has been found useful in predicting the probability of operationally critical airfield ceiling and visibility conditions. One part of the discriminant procedure requires at the outset a rather lengthy computation by machine to estimate these probabilities. Although the operational use of the method takes much less effort, the time needed initially on a large-scale computer may be inordinate when many elements, time periods, and geographical locations are being considered. This technical report discusses a prediction technique, REEP (regression estimation of event probabilities), which resulted from attempts to make MDA more efficient. Comparative studies between REEP and MDA are included, as well as other experimentations performed using the REEP procedure. Author

N64-23199* Rensselaer Polytechnic Inst., Troy, N.Y.
NONLINEAR PROCESS IDENTIFICATION USING STATISTICAL PATTERN MATRICES
Robert W. Miller and Rob Roy [1964] 6 p refs Presented at the JACC, Stanford U., Calif., 1964
(Grants NsG-244-62; AF-AFOSR-279-63)
(IEEE-CP-Paper 3)

Various techniques have been applied to the pattern recognition problem. These techniques include decision theory, regression analysis, and correlation techniques. Some of these methods are based upon detecting features of the pattern (such as corners, edges, loops, etc.). Many such techniques involve "learning" process in that the data from previous patterns, together with the correct classifications, is used to improve the accuracy of recognition. In many cases, the recognition device is given no a priori information as to the criterion for classification, but instead learns to distinguish between patterns as each new pattern is presented to the device. This paper deals with the class of systems whose output depends on the input function over a finite interval. Author

N64-23217 Stanford U., Calif. Computer Science Div.
FAST DIRECT SOLUTION OF POISSON'S EQUATION USING FOURIER ANALYSIS
R. W. Hockney 14 Apr. 1964 40 p refs Presented to the Meeting of A.C.M., Denver, Aug. 1963
(Contract Nonr 225(24); Grant NSF GP-948)
(TR-CS6)

The demand for rapid procedures to solve Poisson's equation has lead to the development of a direct method of solution involving a Fourier analysis that can solve Poisson's equation in a square region covered by a 48 × 48 mesh in 0.9 seconds on the IBM 7090. This compares favorably with the best iterative methods, which would require about 10 seconds to solve the same problem. The method is applicable to rectangular regions with simple boundary conditions, and the maximum observed error in the potential for several random charge distributions is 5×10^{-7} of the maximum potential change in the region. Author

N64-23254 Joint Publications Research Service, Washington, D.C.
A NEW METHOD IN PROBABILITY NUMBER THEORY
Ye. V. Novoselov 16 Jun. 1964 88 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Mat. (Moscow), v. 26, no. 2, 1964 p 307–364
(JPRS-25099; OTS-64-31491) OTS: $2.25

The applications of probability theory (and the integral calculus corresponding to it in the polyadic region) to the distribution problems for values of arithmetic functions and to the problems of calculating their mean values are considered. The study is limited to certain classes of arithmetic functions in which there exists a distribution function, or a mean value. R.T.K.

N64-23256 Joint Publications Research Service, Washington, D.C.
PROGRESS TOWARD A GOAL BY THE RANDOM SEARCH METHOD
V. A. Mutseniyeks and L. A. Rastrigin 22 Jun. 1964 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk Latv. SSR, Ser. Fiz. i Tekhn. Nauk (Riga), no. 2, 1964 p 93–103
(JPRS-25202; OTS-64-31537) OTS: $0.50

The random search method is compared with gradient methods in connection with regulation of multiparameter systems. The most important criterion for success in any given search method is spread, which is partially dependent on the structure of the function to be minimized (i.e., the number of its variables). The paper deals with the ability to determine these properties in working with one of the random search methods. A.W.

N64-23274 California U., Berkeley Operations Research Center
BIBLIOGRAPHY ON MATHEMATICAL PROGRAMMING: QUADRATIC PROGRAMMING, NONLINEAR PROGRAMMING, PROGRAMMING UNDER UNCERTAINTY, INTEGER PROGRAMMING Notes on Operations Research—3
Richard W. Cottle et al 1 Mar. 1964 23 p refs
(NSF-G-21034)
(ORC-64-6(RN))

N64-23292 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BIOTICS FORM THE MAGNETIC TAPE RECORDER
V. Mikhal'chenko and S. Tsikora 6 Feb. 1963 7 p Transl. into ENGLISH from Izv. (Moscow), 25 Mar. 1962 p 4
(FTD-TT-62-1777/1; AD-400513)

This article is concerned with the creation of a bioelectrostimulator by Soviet scientists, offering the possibility of controlling the functioning of individual nerve–muscular systems

and certain organs. Control signals formulated in the cortex cerebri have a specific electric potential that is the basis for this equipment. G.D.B.

N64-23324 Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
RATIOS OF NORMAL VARIABLES AND RATIOS OF SUMS OF VARIABLES Mathematical Note No. 348
George Marsaglia Apr. 1964 19 p refs
(DI-82-0348)

The distribution and density functions of the ratio of two normal random variables are studied. Several representations are given of the distribution function in terms of the bivariate normal distribution and of Nicholson's V function, both of which have been extensively studied, and for which tables and computational procedures are readily available. One of these representations leads to an easy derivation of the density function in terms of the Cauchy density and the normal density and integral. A number of graphs of the possible shapes of the density are given, together with an indication of when the density is unimodal or bimodal. Author

N64-23363 General Electric Co., Philadelphia, Pa. Space Sciences Lab.
MACHINE REDUCTION, COMPUTATION, AND ANALYSIS OF LIGHT CURVES OF ECLIPSING BINARY SYSTEMS
I. Juskevich 1 Apr. 1964 474 p refs
(R64SD8; AD-436026)

An application of automatic computing techniques to the numerical treatment of observed light curves of eclipsing binary systems is presented. Four particular topics are considered: (1) determination of the fundamental periods of light curves; (2) computational aspects of the harmonic analysis of light curves of eclipsing binary systems; (3) application of automatic computing techniques to the rectification of light curves of eclipsing binary systems; and (4) solution of light curves. P.V.E.

N64-23396 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
WORKS OF THE V. A. STEKLOV MATHEMATICAL INSTITUTE (SELECTED ARTICLES)
13 Jun. 1963 36 p refs Transl. into ENGLISH of 2 Articles from Tr. Mat. Inst. Akad. Nauk SSSR, v. 66, 1962 p 4–15, 37–44
(FTD-TT-63-449/1+2+4; AD-413051)

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N64-23397 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
LARGE-BLOCK PROGRAMMING SYSTEM
M. A. Yakovleva *In its* Works of the V. A. Steklov Math. Inst. 13 Jun. 1963 p 1–20 (See N64-23396 16-20)

Described is a programing system for computers that is based on the large-block features, the introduction of cutting operations, and an expansion of a new concept in formula making to insure successful operations. The formula, in the author's opinion, is of the nature of a simple algorithm in which together with the fulfilling of operations shown on the right side, there is the operation of a componentwise premise of the result on the left side. A cut is a value that is not examined independently but as a part of another value, and special symbols are introduced to represent them. Simple and expanded parametric expressions are given. Certain examples are given of the use of the programing system. A.W.

N64-23398 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ANALYTICAL CALCULATIONS ON AN ELECTRONIC COMPUTER FOR THE SOLUTION OF CERTAIN TYPES OF DIFFERENTIAL EQUATIONS
T. N. Pervozvanskaya *In its* Works of the V. A. Steklov Math. Inst. 13 Jun. 1963 p 21–33 refs (See N64-23396 16-20)

The solution is described for a problem concerned with finding a periodic solution of the Van der Pol equation by the method of a small parameter on an electronic computer. Use was made of a universal program realizing calculations written in list symbolism. A problem concerned with the finding of boundaries of the first instability region of the Mathieu equation was also solved. A.W.

N64-23399 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ALGORITHM FOR SOLVING A TRANSPORT PROBLEM BY APPROXIMATING WITH CONDITIONALLY OPTIMUM PLANS
A. L. Lur'ye 20 Feb. 1963 14 p refs Transl. into ENGLISH from the book "Vychislitel'naya Matematika" (USSR), Collection No. 7, 1961 p 151–160 (FTD-TT-62-1498/1; AD-400520)

One of the methods of solving the problem of linear programing is the approximation with "conditionally optimum plans." The corresponding algorithm for the transportation problem is discussed. The nature of the proposed method is reduced to the selection of a system of values x_{ik}, which satisfy the conditions $x_{i_r k_p} = 0$, if $C_{i_r k_p} > \min_i C_{i_r k_p}$, $\sum_k x_{ik} \leq a_i$, $\sum_i x_{ik} \leq b_k$, and $\sum_{i,k} x_{ik} = \max$. L.L.

N64-23403 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MECHANIZATION AND AUTOMATION OF MACHINE (MACHINE TOOL) CONTROL
M. A. Elizabetin 12 Feb. 1963 33 p Transl. into ENGLISH from the book "Mekhanizatsiya i Avtomatsiya v Machinostroyenii" Moscow, Profitekhizdat, 1961 p 58–81
(FTD-TT-62-1246/1+2; AD-401725)

The following are discussed: (1) classification and programing of control systems; (2) open-loop and closed-loop automatic control systems; and (3) control with duplicating programs—mechanical, electromechanical, hydraulic, electrohydraulic, and pneumohydraulic duplicating systems. R.T.

N64-23405 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div
LOGICAL ELEMENT
N. P. Brusentsov 5 Mar. 1963 5 p Transl. into ENGLISH from Soviet Patent No. 145070, 22 Feb. 1961 p 1–3
(FTD-TT-62-1500/1+2; AD-400537)

A logical element is described that eliminates the shunting effect of restrictive windings. It prevents the return of information into the preceding stage (of processing) and stabilizes the amplitude of the output current pulse. A schematic diagram of the element is given. R.T.K.

N64-23436 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SOLVING AN ALGEBRAIC EQUATION OF N-POWER WITH REAL POSITIVE ROOTS WITH THE AID OF A PROGRAM ON A COMPUTER OF NATIONAL-ELLIOT 803 TYPE

Vasil Ivanov and Milan Picek 26 Mar. 1964 11 p refs Transl. into ENGLISH from Aplikace Mat. (Prague), v. 8, no. 3, 1963 p 216-223
(FTD-TT-63-1032/1+2; AD-439580)

A method, based on classical Newton principles, of solving algebraic equations of *n*-power is presented. The values of the functions and derivatives corresponding to the functions are calculated through the use of Herner principles. With this method each subsequent root of the equation can be found directly by using the value of the preceding root (without using an approximate root value). P.V.E.

N64-23531* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TABLES OF THE COMPLEX FRESNEL INTEGRAL

C. William Martz Washington, NASA, 1964 298 p refs (NASA-SP-3010) OTS: $4.00

The complex Fresnel integral defined by

$$\int_0^{x+iy} \exp\left(\frac{i\pi u^2}{2}\right) du$$

is evaluated by means of Taylor's series expansions. The real and imaginary parts, accurate to five significant figures, are tabulated essentially throughout the complex plane, except in the regions $xy < -6.8$. Tabulation intervals in the x-direction are 0.02 for $0 \leq X \leq 10$, and 0.01 for $10 \leq X \leq 20$. Similar intervals apply in the y and $-y$ directions. An error analysis is presented of the methods used to evaluate the integrals. Author

N64-23533 Joint Publications Research Service, Washington, D.C.

UNIT FOR MEASURING INTEGRAL AND DIFFERENTIAL TWO-DIMENSIONAL FUNCTIONS OF DISTRIBUTION

V. A. Pryanishnikov *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 1-9 refs (See N64-23532 16-01) OTS: $3.00

The subject of this article is a unit investigated and developed for measuring two-dimensional integral and differential functions of distribution of signals having a frequency spectrum from 5 to 1,000 cps. The results of experimental testing of the unit are given. Author

N64-23535 Joint Publications Research Service, Washington, D.C.

CERTAIN PRINCIPLES GOVERNING THE DESIGN OF MEMORY DEVICES WITH FERRITE CORES AND FULL-CURRENT RECORDING

Ye. P. Balashov and V. L. Genkin *In its* News of Higher Educational Inst., Min. of Higher and Secondary Specialized Educ. USSR, Instr. Bldg. Ser. 31 Jan. 1964 p 20-27 refs (See N64-23532 16-01) OTS: $3.00

Under consideration are the principles governing the design of memory devices with cores having a rectangular hysteresis loop, in which the recording and reading of the information is effected by full switching currents; this makes it possible for the magnetic storage to operate more reliably than the memory devices based on coincidence of currents and to reduce the total time spent in using the storage device. Three possible versions of memory devices with full currents are suggested. Author

N64-23556 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THREE THEOREMS ABOUT THE STRONG MINIMUM IN THE CLASSICAL PROBLEM OF THE CALCULUS OF VARIATIONS

V. F. Krotov *In its* Mech. 28 Aug. 1963 p 72-91 refs (See N64-23551 16-01)

The classical theories of Lagrange and Euler are incorporated in a new theory of the calculus of variables. The author established the ability to arrive at solutions of the extremum of a function through discontinuous functions as well as continuous ones, and without the necessity of integrating the differential equations of Lagrange and Euler. A.W.

N64-23672 Massachusetts Inst. of Tech., Cambridge Instrumentation Lab.

ATTITUDE DETERMINATION OF A SPHERICAL IMU

Donald Garmer Feb. 1964 53 p
(Contract AF 04(694)-305)
(R-435; AD-437123)

In considering spherical attitude readout, the problem is divided into three major areas—geometry, measurement, and computer. The geometry part of the problem is concerned with a definition of the parameters to be measured. The words "attitude readout" have to be interpreted mathematically. Once the parameters are defined it is necessary to develop a technique for measuring them. Extensive laboratory experiments are necessary in achieving that end. Finally, the output of the measurement procedures must be manipulated in a computer so that a desirable form of the attitude information is available. A mathematical analysis of these areas and the geometry of a rig used for testing are discussed. Author

N64-23673 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

AN ALGORITHM FOR BOUNDARY PROBLEM SOLUTION

R. I. Stakhovskiy 20 Mar. 1964 25 p refs Transl. into ENGLISH from Avtomat. i Telemekh. (Moscow), v. 24, no. 7, 1963 p 962-974
(FTD-TT-63-1078/1+2; AD-437116)

An algorithm for computer solution of boundary problems is proposed. A modification of the direct search method is discussed with respect to the given algorithm. Proof of the uniqueness of the minimum of the adopted optimization criterion is given for certain classes of differential equations describing the controlled plant. Author

N64-23803 Joint Publications Research Service, Washington, D.C.

SOME METHODS OF COMBINING OPERATIVE AND PERMANENT MEMORIES

N. S. Anishin *In its* Izv VUZov: Radiophys. 18 May 1964 p 258-267 ref (See N64-23783 16-28) OTS: $5.00

Combining the reading windings in the number bus, combining the reading windings outside the number bus, and using circuits without commutators are the three methods considered for combining ferrite operative and permanent memories. By using these methods, good standards of technology and economy are achieved. G.D.B.

N64-23906 RAND Corp., Santa Monica, Calif.
ON THE COMPUTATIONAL SOLUTION OF TWO-POINT BOUNDARY-VALUE PROBLEMS
Richard Bellman and Thomas A. Brown Apr. 1964 8 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3857-PR; AD-436753)

Two-point boundary-value problems for second-order systems of linear differential equations are usually solved by a process involving the inversion of a certain matrix. If the system is too large, it may be difficult to compute this inverse to a high degree of accuracy. The purpose of this paper is to demonstrate that this difficulty can in some cases be circumvented by applying a method like that of Bodewig and Hotelling. Author

N64-23921 Land-Air, Inc., Point Mugu, Calif. Paradyn Div.
AN APPLICATION OF SEQUENTIAL ANALYSIS TO A TARGETING PROBLEM
Eberhard H. Baur 20 Jul. 1962 15 p refs
(Contract N-123(61756)19425A/PMR)
(Rept.-33)

In any simulated nuclear attack with large missiles on expanded targets, the statistical experiment always indicates "success" or "failure" for the attack. A sequential analysis procedure decides in a Monte Carlo series with the events "success" or "failure", whether or not the basic probability q for "success" is over or under 90%. The parameters for the sequential analysis procedure were calculated for the following regions of uncertain decisions: $(90 \pm \Delta q)\%$, with $\Delta q = 2, 2.5, 3, 4, 5$. If q is outside these regions, the decisions are right with a confidence level of greater than 95%. In order to insure these confidence levels, lower limits of the number of trials for an arbitrary process determination are calculated. Besides the specific application to targeting problems, the procedure can also be used for every other binomial distribution. Author

N64-23922 Cornell U., Ithaca, N.Y.
MOMENTS OF THE ABSORPTION TIME IN A FINITE MARKOV CHAIN Technical Report No. 16
D. S. Robson Mar. 1964 5 p
(Contract Nonr-401(39))
(BU-163-M; AD-436574)

If all recurrent states are included in a closed subset $E_j = U_{j \epsilon J} E_i$ of states in a finite Markov chain, then the probability

$$F_{iJ}(t) = \sum_{j \epsilon J}^{(t)} p_{ij} = \sum_{k}^{(1)} p_{ik} F_{kJ}(t-1)$$

represents the cumulative probability distribution of a random variable T_{iJ}, the number of steps required for a chain that starts in E_i to first reach E_J. The moments of T_{iJ} may be obtained directly as linear functions of the one-step transition probabilities, as

$$\epsilon(T_{iJ}) - 1 = \sum_{k \epsilon J}^{(1)} p_{ik} \epsilon(T_{kJ}) \text{ and}$$

$$\epsilon(T_{iJ}^2) - 2\epsilon(T_{iJ}) + 1 = \sum_{k \epsilon J}^{(1)} p_{ik} \epsilon(T_{kJ}^2).$$

Author

N64-23971* IIT Research Inst., Chicago, Ill.
A STUDY OF DIGITAL COMPUTERS FOR A REAL TIME TRAINING STIMULATION RESEARCH SYSTEM
Kenneth W. Andresen and Duncan Ewing May 1964 107 p refs
(Contract AF 33(657)-11007)
(AMRL-TDR-64-22; AD-601649)

Requirements for the computer hinge on a real time operating capability that stresses high computation rates. Significant characteristics include the following: (1) an operating rate in excess of 75,000 instructions per second on flight simulation problems; (2) a memory capacity of at least 8,000 words; (3) a computer word length of at least 24 bits, and (4) at least three index registers. The results of the study phase is a recommendation of the Packard Bell 440 as the central computer of the simulation system; and as an alternative, a recommendation of the faster SDS 9300 computer is made provided its higher cost and later delivery time are acceptable. The recommended interface equipment will include a multiplexed analog-to-digital conversion subsystem capable of digitizing 32 input channels to 12 bits at a rate in excess of 35,000 conversions per second, a dual resolution digital-to-analog conversion system supplying 64 analog outputs to analog equipment, 72 sense inputs, 72 control outputs, and a digital interval timer. Author

N64-23991* Maryland U., College Park Computer Science Center
NUMERICAL ANALYSIS IN RESIDUE NUMBER SYSTEMS
George E. Lindamood (M.A. Thesis) May 1964 168 p refs
(Grant NsG-398)
(NASA-CR-56297; TR-64-7) OTS: $12.00 ph

Recent attempts to utilize residue number systems in digital computers have raised numerous questions about adapting the techniques of numerical analysis to residue number systems. Among these questions are the fundamental problems of how to compare the magnitudes of two numbers, how to detect additive and multiplicative overflow, and how to divide in residue number systems. These three problems are discussed, and methods are developed whereby magnitude comparison, overflow detection, and division can be performed in residue number systems. The division method is extended to provide an algorithm for the direct approximation of square roots in residue number systems. Examples are provided to illustrate the nature of the problems considered and to show the use of the solutions presented in practical computations. Results are presented of extensive trial calculations for which a conventional digital computer was programed to simulate the use of the division and square-root algorithms in approximating quotients and square roots in residue number systems. R.T.L.

N64-24019* Martin Co., Baltimore, Md. Research Inst. for Advanced Studies
ON NON-LINEAR BOUNDARY VALUE TYPE PROBLEMS
R. Conti (Florence U.) [1964] 19 p refs
(Contracts NASw-845; AF 49(638)-1242; Nonr-3693(00))
(NASA-CR-56652) OTS: $1.60 ph

Sections 1 and 2 are concerned with a discussion of assumptions that allow the reduction of: (S) $L_1X = H_1X$, $L_2X = H_2X$ to a single equation (T) $X = TX$. Sections 3 and 4 give some criteria for (S) via (T), and in Sections 5 and 6 a boundary-value problem for an ordinary differential equation is considered as an application of (S) into (T). A.V.

N64-24034* Space Technology Labs., Inc., Los Angeles, Calif.
A NOTE ON PRODUCT DEMODULATION OF BINARY PCM/PM SIGNALS
Jean A. Develet, Jr. 12 Feb. 1961 17 p refs
(Contract NAS5-825)
(NASA-CR-56621; Rept-8949-0002-NU-000) OTS: $1.60 ph

This paper presents formulations that relate average received signal power, noise density, and bit rate of the source to the expected probability of bit error in the received information for binary phase modulation systems. The performance of these systems is analyzed for the case of product demodulation. The received signals are assumed corrupted with additive white gaussian noise. The following modulations are analyzed explicitly: (1) direct-carrier-phase reversal; (2) sinusoidal-subcarrier-phase reversal for optimal correlation detection and sinusoidal correlation detection. Some general results are obtained for the situation where an arbitrary carrier-phase-modulating waveform is reversed in sign to convey information. Author

N64-24120* American Mathematical Society, New York, N.Y.
LECTURE NOTES PREPARED IN CONNECTION WITH THE SUMMER SEMINAR ON SPACE MATHEMATICS, PART IV
S. V. Parter et al [1963] 243 p refs Seminar held at Cornell U., Ithaca, N.Y., 1 Jul. 1963–9 Aug. 1963
(Grants NsG-358; AF-AFOSR-258-63; Contracts DA-31-124-ARO(D)-82; AT(30-1)-3164; Nonr(G)00025-63 et al)
(NASA-CR-56195)

This collection of lecture notes on space mathematics includes special computation procedures for differential equations. Qualitative methods for the *n*-body problem are presented. An outline is given of a theory of nonperiodic motions in the neighborhood of the long-period librations about the equilateral points of a restricted three-body problem. Discussed are the elements of a theory of librational motions in the elliptical restricted problem. Shock waves in rarefied gases are described. Basic fluid dynamics are included in these notes. G.D.B.

N64-24123* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE ORBIT DETERMINATION PROGRAM OF THE JET PROPULSION LAB.
M. R. Warner, M. W. Nead, and R. H. Hudson 18 Mar. 1964 120 p refs
(Contract NAS7-100)
(NASA-CR-56565; JPL-TM-33-168)

A computer program for determining the optimum least-squares estimates of spacecraft orbital parameters and certain physical and observational constants has been written. A discussion of the theoretical basis of the program and flow diagrams of the computing procedure are presented. A description of the operation of the program, including input formats, is included. Author

N64-24180 Stanford U., Calif. Applied Mathematics and Statistics Labs.
SELECTION AND RANKING PROCEDURES AND ORDER STATISTICS FOR THE BINOMIAL DISTRIBUTION
Shanti S. Gupta (Purdue U.) 24 Sep. 1963 18 p refs
(Contracts Nonr-225(53); AF 33(657-11737))
(TR-68; AD-421011)

This paper describes some work on selection and ranking procedures for binomial populations. The procedures discussed are divided into procedures for selecting a subset containing the best population or all those populations that are better than a standard, and procedures for selecting the best. This paper also discusses order statistics from the binomial distribution and describes some new tables of moments and cumulative distribution function of these order statistics. Author

21 METEOROLOGY

Includes climatology; weather forecasting; and lower atmosphere studies. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 29 Space Sciences.

N64-22934* National Aeronautics and Space Administration, Washington, D.C.
REQUIREMENTS FOR ACCURACY IN OBTAINING METEOROLOGICAL DATA FROM AN ARTIFICIAL EARTH SATELLITE [O TREBOVANIYAKH k TOCHNOSTI POLUCHENIYA METEOROLOGICHESKOY INFORMATSII s ISKUSSTVENNYKH SPUTNIKOV ZEMLI]
B. M. Novikov and V. A. Zyabrikov Feb. 1964 12 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v 1, no. 2, Sep.–Oct 1963 p 249–255
(NASA-TT-F-8816)

Established are the requirements that must be met in designing satellite-borne apparatus for determining cloudiness and air and surface temperatures. On the basis of the problem of analyzing and forecasting meteorological conditions, the minimum necessary area of the resolvable element in photographing cloud fields is evaluated and the permissible errors in determining the air temperature at different heights, and the surface temperature are computed. Author

N64-23166 National Weather Satellite Center, Washington, D.C. Meteorological Satellite Lab.
TIROS CLOUD PATTERN MORPHOLOGY OF SOME MID-LATITUDE WEATHER SYSTEMS
Harold J. Brodrick, Jr. Jan. 1964 33 p refs
(Rept.-24; AD-433485)

In the search for ways of using satellite-observed cloud patterns to supplement conventional meteorological observations in data-sparse areas, a study of the connection between cloudiness and vorticity advection was undertaken. The cases were chosen from TIROS IV on the basis of the presence of a recognizable cyclonic or frontal cloud mass, and the cloud patterns were compared with a number of parameters characterizing the circulation and thermal structure of the atmosphere. The differences in cloud pattern structure appeared to be significantly associated with these factors: (1) the tilt of the circulation system; (2) the amplitude of the thermal pattern; and (3) the orientation and gradients of the thickness pattern. The results indicate that considerable information about the three-dimensional structure of the atmosphere can be inferred from the satellite-viewed cloud structures. Author

N64-23174 Bollay (E.) Associates, Inc., Santa Barbara, Calif.
OPTIMIZATION STUDIES IN THE COMMON AVIATION WEATHER SYSTEM DATA PRESENTATION SUBSYSTEM Final Report
D. Goodale and G. Pearson Mar. 1964 196 p refs
(Contract FA-WA-4403)
(RD-64-59)

The results of several optimization studies within the presentation subsystem of the CAWS are discussed. Detailed plan views of the pilot briefing facility, aviation weather facility, and the pilot-to-forecaster service illustrate the desired principles of sound layout as discussed for each facility. Examples of integrated combinations of these facilities that may occur within the system are also discussed and illustrated. Personnel procedures, as they are concerned with acquisition and dissemination of weather information in these facilities, were analyzed and tabulated. The existing CAWS graphic formats were examined and further optimized to be compatible with developmental display hardware. Alpha–numeric formats have been reconfigured from the previous CAWS formats only in that the fixed-data portion of the message was shortened slightly and several formatting operations were further defined. Formats for interim use, prior to the full implementation of the CAWS formats, were developed and illustrated. Both alpha-numeric and graphic forms are proposed for use with existing communication and display equipment. A special study determined that character height should not be less than 1.63% of the frame height when used for display of weather information over a 945-line scan CCTV system. Author

N64-23261 Michigan State U., East Lansing
A SIMPLIFIED MODEL FOR THE FORMATION, MOVEMENT, AND DISSIPATION OF FAIR WEATHER CUMULUS CLOUDS
Scientific Report No. 1
Martin Fox 29 May 1964 23 p refs
(Contract AF 19(628)-355)
(RM-113; MF-5; AFCRL-64-318; AD-600835)

Certain patches of ground are favorable for the formation of fair-weather cumulus clouds. This fact is used in this study to develop a stochastic model for the temporal evolution of the contribution to cloud cover by fair-weather cumuli. The model described is useful in its simplicity for explaining to meteorologists and climatologists how stochastic models may be used in their problems. G.D.B.

N64-23862 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACCURACY DEMANDS FOR DETERMINATION OF INFRARED RADIATION FLUX WITH THE HELP OF ARTIFICIAL EARTH SATELLITES AND A METHOD FOR CALCULATING THE HEIGHT OF THE UPPER CLOUD BOUNDARY
L. T. Matveyev *In its* Cosmic Res. 27 Apr. 1964 p 167–187 refs (See N64-23852 16-21)

A theory has been worked out for determination of the upper cloud cover boundary, taking into account turbulent exchange, vertical motions, radiational cooling, and precipitation. The formulas obtained for the height of the upper cloud-cover boundary are used for quantitative-measurement accuracy surveys of infrared radiation flux. With a permissible error of ±500 m in the determination of the height of the upper cloud-cover boundary, the accuracy of measuring the infrared radiation flux should be 1% to 2%. Author

N64-23869* National Aeronautics and Space Administration, Washington, D.C.
METEOROLOGICAL OBSERVATIONS ABOVE 30 KILOMETERS
1964 61 p refs A Part of the Proc. of the Conf. on Meteorol. Testing and Operation, Colo. State U., Fort Collins, 11–12 Jul. 1963; Sponsored by AIAA and Am. Meteorol. Soc.
(NASA-SP-49) GPO: $0.40

CONTENTS:

1. THE STRATO-MESOSPHERIC METEOROLOGICAL ROCKET John E. Masterson (Pacific Missile Range) p 1–13 refs (See N64-23870 16-32)

2. APPLICATION OF METEOROLOGICAL ROCKET NETWORK DATA Sidney Teweles (Weather Bur.) p 15–35 refs (See N64-23871 16-21)

3. ROCKET SOUNDINGS IN THE MESOSPHERE William Nordberg (NASA, Goddard Space Flight Center) p 37–57 refs (See N64-23872 16-21)

N64-23871* Weather Bureau, Washington, D.C.
APPLICATION OF METEOROLOGICAL ROCKET NETWORK DATA
Sidney Teweles *In* NASA. Meteorol. Observations Above 30 Kilometers 1964 p 15–35 refs (See N64-23869 16-21)
GPO: $0.40

The development of the comparatively inexpensive Meteorological Rocket Network (MRN) in 1959 is discussed. Since then the capability for synoptic analysis has greatly risen. The most important single use of the rocket has been immediate launching-site support for major missile firings. Climatological applications of MRN data and analysis of synoptic charts from MRN data comprise this report. A.W.

N64-23872* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ROCKET SOUNDINGS IN THE MESOSPHERE
William Nordberg *In* NASA, Washington. Meteorol. Observations above 30 Kilometers 1964 p 37–57 refs (See N64-23869 16-21) GPO: $0.40

The mesosphere is that part of the atmospheric region between 50 km and 90 km that is bounded by the stratosphere at the bottom and the thermosphere at the top; it is the highest region of the atmosphere where circulation systems in the meteorological sense have been observed. Rocket vehicles of medium category are the best suited for experiments in the mesosphere; the only successful use of small rockets has been in measuring wind by dispersion of chaff. Recent progress in the rocket program for the mesosphere is noted, outstanding problems are listed, and certain observations are made on the pitot-static tube. A.W.

N64-23905 Travelers Research Center, Inc., Hartford, Conn.
WEATHER DATA PROCESSING RESEARCH AND DEVELOPMENT PROGRAM
C. F. Jenkins Mar. 1964 23 p
(Contract Cwb-10704)
(AD-437483)

The following tasks are summarized: (1) statistical prediction of weather parameters; (2) development of derived predictors; (3) scale analysis of terminal (airport) weather variations; (4) prediction technique development; (5) radar application in terminal and enroute weather forecasting; and (6) analysis and prediction of inflight weather elements. P.V.E.

N64-24018* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
COMPUTER EVALUATION OF WINDS FROM METEOROLOGICAL ROCKETSONDE MEASUREMENTS
Bettye Anne Case 4 Jan. 1963 22 p refs
(NASA-TM-X-51743; MTP-AERO-63-3) OTS: $2.60 ph

This report presents a method for determining wind and wind shear measurements, ground track, and fall rate o

target from radar measured spherical position coordinates of a descending target. Due to errors inherent in the original measurements, it is considered that this method produces more representative values for altitude levels widely spaced with respect to time-sequenced data records than methods using interpolations. These computational procedures provide a means for excluding only time records determined erroneous in a given observation. The final tabulations give measurements that are averaged over approximately 500-meter layers, and centered at the designated altitude level. Since data at altitude levels from 30 to 70 km are relatively sparse, the desire to use all the representative data in a given observation, even if it contained some obviously erroneous time records, led to the application of certain arbitrary mathematical standards for acceptable raw data. The theory involved in the data editing and evaluation procedures is discussed. The method is currently in use to evaluate data for a number of rocketsonde observations as well as for rocketsonde measurements used in flight evaluations. Author

N64-24024* Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
PROJECT FOG DROPS: INVESTIGATION OF WARM FOG PROPERTIES AND FOG MODIFICATION CONCEPTS Third Quarterly Progress Report, 1 Aug.–1 Nov. 1963
J. E. Jiusto and G. E. Mc Vehil [1963] 13 p refs
(Contract NASr-156)
(NASA-CR-52851; CAL-RM-1788-P-3) OTS: $1.60 ph

The effects of fatty alcohol monolayers on water droplets, and on condensation nuclei (NaCl crystals) were studied. The degree of retardation of growth (evaporation) of monolayer treated drops is dependent upon material type, compression of the monolayer, and absence of film impurities. Preliminary tests suggest that condensation nuclei activity can be influenced by monolayer materials. Study of droplets treated with ionic surfactants was commenced. Meteorological analysis of a Buffalo fog provided further insight into the dynamics of fog formation. Author

N64-24028* Chicago U., Ill.
OUTLINE OF A THEORY AND EXAMPLES FOR PRECISE ANALYSIS OF SATELLITE RADIATION DATA Research Paper No. 15
Tetsuya Fujita Feb. 1963 38 p
(Grants NsG-333; Cwb-WBG-6)
(NASA-CR-56296) OTS: $3.60 ph

A method for determining basic values for weather or physical research on radiation data collected by Tiros II, III, and IV is presented in the form of charts, graphs, and overlays. Basic geometry, analysis on OEC charts, and specific examples are given. The basic values are the zenith angle and azimuth of the satellite viewed from the scan points on the earth, the areas of scan points on the earth, and the zenith angle and azimuth of the sun viewed from the scan points on the earth. G.D.B.

N64-24062 Florida State U., Tallahassee
TROPICAL CONVECTIVE AND SYNOPTIC SCALE WEATHER SYSTEMS AND THEIR STATISTICAL CONTRIBUTIONS TO TROPICAL CLIMATOLOGY Final Report
N. E. La Seur and M. Garstang Mar. 1964 75 p refs
(Grants DA-SIG-36-039-62-G23; DA-ARO-49-092-63-G23)
(AD-435579)

A detailed outline is presented of the climatological and observational data collected during the 15-month field program. The manner in which the data were collected is described, and an assessment is made of the amount, quality, and present and final forms of the data. A description is given of the way in which the results of the field program will be analyzed, together with a summary of proposed studies based upon these data. Preliminary results of a study on the diurnal distribution of precipitation and cloudiness is presented. Author

22 NAVIGATION AND GUIDANCE

Includes autopilots; star tracking; inertial platforms; and air traffic control. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; 20 Mathematics; and 29 Space Sciences.

N64-22925 George Washington U., Washington, D.C. Human Resources Research Office
ADVANCED LAND NAVIGATION: DEVELOPMENT AND EVALUATION OF A PROTOTYPE PROGRAM OF INSTRUCTION
Theodore R. Powers Apr. 1964 55 p refs
(HumRRO-TR-89; AD-600749)

To enable infantrymen to acquire proficiency in advanced land navigation (ALN) techniques, and ALN performance requirement at the level of infantry advanced individual training (AIT) was developed. Graduates of infantry AIT were tested on navigational routes of the level of difficulty prescribed by the performance requirement. A 10-h prototype program of instruction was administered to 100 enlisted men whose performance was then evaluated on the prescribed navigational routes. In the experimental group, 50% of the men met the prescribed daytime performance requirement, as opposed to 5% of those without the experimental training; 76% met the performance requirement for nighttime navigation. The 10-hr program of instruction in ALN can be used to train enlisted men to navigate accurately over difficult, unfamiliar terrain under all conditions of visibility. Author

N64-22959 Navy Electronics Lab., San Diego, Calif.
DEPTH REGULATION OF LOWERED OCEANOGRAPHIC EQUIPMENT
C. J. Shipek and E. C. Evans 27 Mar. 1964 14 p refs
(NEL-1215; AD-600187)

An experimental, low-cost, depth regulation equipment has been developed. It consists of a bellows-type depth sensor together with phase and power amplifiers, servo units, and hoist-train equipment. Dockside tests of the equipment with a small portable electric winch were successful. They indicated that up to 85% of unwanted vertical wire motion can be eliminated when lowering oceanographic devices from floating platforms. Author

N64-22965 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
WIDE-RANGE SCINTILLATION DETECTOR FOR AERIAL RADIOLOGICAL SURVEY
Joseph C. Nirschl and Frank C. Genovese Aug. 1963 36 p refs
(USAELRDL-TR-2397; AD-601092)

This report describes the development of an aerial radiac set having a scintillation detector and log pentode converter.

The evolved circuitry of the aerial radiac set is completely transistorized, except for the miniature log converter tube (Nuvistor). The aerial radiac set accepts the signal from a radar altimeter for automatic altitude correction. It features a presettable alarm, a telemetry output, and a chart recorder. The dynamic range of the instrument is four decades (0.01 to 100 r/hr.); the detector speed of response is less than 0.1 sec. A regulated power supply permits operation off the 28-v aircraft supply. Author

N64-23026* National Aeronautics and Space Administration, Washington, D.C.
EXPLORER XVII (1963 9A) REAL TIME PCM TELEMETRY DATA PROCESSING AND DISP AV TEST STAND
M. M. Grant, C. C. Stephanides, and W. N. Stewart Washington, NASA, Jun. 1964 61 p
(NASA-TN-D-2318) OTS: $1.75

This spacecraft operated on command, consumed high power, and had the highest PCM telemetry data rate of any scientific satellite at the date of launch. A major problem related to the development, test, and orbital monitoring of this spacecraft was the quick and accurate evaluation of the telemetry data. The problem was solved by incorporating an automatic data processing system as an integral part of the spacecraft telemetry test stand. Two such systems were utilized in the integration, test, and prelaunch phases and for orbital monitoring throughout the scheduled 100-day satellite lifetime. Author

N64-23118* National Aeronautics and Space Administration, Washington, D.C.
SOME PROBLEMS ASSOCIATED WITH THE INTERPRETATION OF THE RESULTS OF MEASURING THE OUTGOING RADIATION BY MEANS OF METEOROLOGICAL SATELLITES [NEKOTORYYE PROBLEMY INTERPRETATSII REZUL'TATOV IZMERENIY UKHODYASHCHEGO UZLUCHENIYA PRI POMOSHCHI METEOROLOGICHESKIKH SPUTNIKOV]
K. Ya. Kondrat'yev [1963] 20 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow) v. 1, no. 1, 1963 p 98-112
(NASA-TT-F-8563)

The problems discussed are as follows: (1) obtaining the necessary information—reduction of outgoing-radiation sensor readings to a given altitude, effect of the nonhorizontal position of the sensing surface, interpreting the readings of narrow-angle radiation sensors; (2) descriptive analysis of information obtained—charts and statistical analyses of radiation field; (3) application of radiation data to synoptic analysis and forecast; (4) application of radiation data to numerical methods for predicting weather and climate; and (5) development of optical methods for satellites that would increase the scope of meteorological information (meteorological astrophysics). E.K.R.

N64-23238 Federal Aviation Agency, Atlantic City, N.J. Research Div.
TERRAIN AND WEATHER EFFECTS ON DOPPLER RADAR NAVIGATION SYSTEMS Final Report
E. Laskowski Jan. 1964 30 p refs
(RD-64-15)

The effects of terrain and weather conditions upon airborne Doppler radar performance are described. The extensive flight test data compiled by military and commercial users of the Doppler radar and theoretical knowledge of propagation and scattering theory were used as a basis for this study. The effects of terrain and weather are analyzed in terms of their effect upon the signal-to-noise ratio received at the Doppler set. In addition, the effect of intense rain cells upon the accuracy of the sensed velocity vector is discussed. Doppler signal attenuation due to atmospheric gases and various weather conditions is given. Charts illustrate the reduction of signal strength due to increased aircraft operating altitude and increased speed. The need for adequate signal reserve in high-performance aircraft such as the supersonic transport is indicated. Auth

N64-23272 Library of Congress, Washington, D.C. Aerospace Information Div.
SOVIET METEOROLOGY AND CLIMATOLOGY Compilation of Abstracts and Annotated Bibliography [1960-196
2 Jun. 1964 104 p refs Transl. into ENGLISH from Soviet Periodicals
(AID-P-64-37; AD-601123) OTS: $9.10 ph

This is a compilation of abstracts and an annotated bibliography of Soviet meteorology and climatology from the Geophysical Reference Journals of 1962 and 1963 published in the U.S.S.R. Weather forecasting, cloud frequency and distribution, and ice accretion and glaze are covered. G.D.

N64-23288 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NAVIGATION AIDS IN PROTECTION OF GROUND FORCES BY FIGHTER AVIATION
Z. Guminski 4 Feb. 1963 7 p Transl. into ENGLISH from Wojskowy Przeglad Lotniczy (Warsaw), no. 1, 1962 p 13-1
(FTD-TT-62-1704/1; AD-298222)

Fighter aircraft that are protecting forces engaged with the enemy must act beyond the front lines; fighters assigned over enemy territory must remain there only a short time. Boundaries of transmitting the vectoring of fighters in the air from one point to another must be ascertained in advance. This paper discusses these navigation aids for fighters. G.D.

N64-23450 George Washington U., Washington, D.C. Human Resources Research Office
A SERIES OF EXPERIMENTAL INVESTIGATIONS OF THE LAND NAVIGATION PROCESS
Theodore R. Powers Jan. 1964 41 p
(Contract DA-44-188-ARO-2)
(HumRRO-30; AD-601243)

This memorandum presents a series of experimental investigations conducted by the U.S. Army Human Research Unit, Fort Benning, Georgia. The investigations include: (1) the land navigational ability of the infantryman (the movement from point to point across unfamiliar terrain); (2) the variability of the individual pace count; (3) the ability to determine a 90° angle by utilizing body movements; and (4) the

standard Army lensatic compass (the major direction finder used by the infantryman during the landing process). The physical factors characterizing routes at three levels of navigational difficulty are presented. I.v.L.

N64-23520* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING SYSTEM DATA ANALYSIS REPORT, RANGER 4 Final Report
W. R. Wollenhaupt 1 Mar. 1964 112 p refs
(Contract NAS7-100)
(NASA-CR-56559; JPL-TR-32-523) OTS: $9.60 ph

The analysis of the Deep Space Instrumentation Facility (DSIF) spacecraft tracking performance during the Ranger 4 mission is summarized. Included are ground system configurations, station view periods, and a discussion by station and view period of all tracking data, i.e., angular and Doppler, taken by the tracking stations. Also presented is a summary of the tracking data that were actually used in determining the spacecraft orbit, and the noise statistics of these data. Author

N64-23606 Naval Research Lab., Washington, D.C. Applications Research Div.
DECAY PREDICTION OF 1963-21 USING U.S. NAVAL SPACE SURVEILLANCE SYSTEM OBSERVATIONS
R. Brescia, D. Ballou, and R. Zirm 2 Mar. 1964 9 p
(NRL-6049; AD-435551)

The multiple launch of 1963-21 suffered a malfunction in the orbital injection motor that left the orbiting bodies in the transfer ellipse rather than the intended circular orbit of 500 miles. Because of the approximately 100-mile-high perigees, the periods of the several objects decayed to reentry in time intervals of some 2 to 8 weeks. Early observation suggested that decay rates were approximately inversely proportional to the ballistic coefficients. From this, it was possible to predict the reentry times of the longer lasting satellites from the behavior of the first one to reenter. Simple curve fitting was tried as a method of refining predictions. Author

N64-23613* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
1964 STATE OF THE ART NAVIGATION, GUIDANCE AND CONTROL
Robert Clifton Duncan N.Y., AIAA [1964] 20 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.-2 Jul. 1964
(AIAA Paper-64-500) AIAA: $0.50 members, $1.00 nonmembers

This report is a review of the current status of navigation, guidance, and control in terms of its history, present technology, progress in the past year, and future plans. The scope of the work is general and informative, providing an overall view of the subject. G.D.B.

N64-23675 Ion Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium)
APPROXIMATE ANALYSIS OF OPTIMUM LOW THRUST TRANSFER BETWEEN COPLANAR HYPERBOLIC ORBITS
L. Moulin May 1964 25 p refs
(Grant AF-EOAR-63-39)
(VKI-TN-15)

Optimization of low-thrust transfer between coplanar hyperbolic orbits has been analyzed, on the basis of an approximate analytical solution, in the case of constant thrust set at a constant angle to the velocity vector. The investigation bears upon minimization of fuel consumption and selection of an ideal initial orbit. For given initial and final orbits it is shown that optimum conditions can be obtained with tangential thrust. Further refinement consists of a proper selection of the angular momentum of the initial orbit, so as to either initiate or terminate low-thrust propulsion as close as possible to perigee, depending upon the direction of transfer. Author

N64-24044 Control Data Corp., Minneapolis, Minn. Research Div.
FEASIBILITY STUDY OF A TRACK-WHILE-SCAN NAVIGATION CONCEPT
Joseph E. Carroll 29 Jul. 1963 42 p refs
(Contract NAS1-2902)
(NASA-CR-56455; CDC-TM-9552-2) OTS: $4.60 ph

A computer program is described that performs a Monte Carlo error analysis on the scanning camera navigation concept. Errors are added to otherwise perfect measurements of the target slit scan times, and the camera position and attitude are determined from these times. This memorandum concentrates on Program A, the first in a series of increasingly sophisticated programs. The assumptions basic to this program are as follows: (1) stars and planets are point sources, the planets revolving in circles in the ecliptic, and the stars fixed in the 1950.0 celestial sphere; (2) the camera rotates at a constant and known rate about a spin axis fixed in inertial space; (3) rms time errors are the same for all targets and those equivalent to rms angle errors of 2 and 10 seconds of arc are examined; and (4) the 50 brightest stars and 9 planets are the only targets, and they have already been identified. The discussion and derivation of pertinent equations form the bulk of this memorandum. Author

23 PHYSICS, GENERAL

Includes acoustics; cyrogenics; and optics. *For astrophysics see*: 05 Astronomy and Astrophysics. *For related information see*: 12 Geophysics; 29 Space Sciences; 24 Physics, Plasma; and 25 Physics, Solid-State.

N64-22737 Joint Publications Research Service, Washington, D.C.
ON THE MECHANISM AND LIMITS OF SPONTANEOUS CHAIN IGNITION OF HYDROGEN WITH OXYGEN IN SHOCK WAVES
V. V. Voyevodskiy 16 Jun. 1964 9p refs Transl. into ENGLISH from Dok. Akad. Nauk SSSR (Moscow), v. 154, no. 6, 1964 p 1425-1428
(JPRS-25-103; OTS-64-31493)

With decreasing temperature in some gas systems, a notable change in the character of ignition and in the formation of detonations upon their compression by a shock wave was noted with the transition through a defined temperature range. Detailed analysis of data at various temperatures and

pressures of the gas behind a reflected shock wave showed that the temperature of the transition from one detonation to the other in a mixture of H_2+O_2 decreases with decreasing pressure. G.D.B.

N64-22801* National Aeronautics and Space Administration, Washington, D.C.
THEORY OF ANISOTROPIC SHELLS
S. A. Ambartsumyan May 1964 404 p refs Transl into ENGLISH of the book "Teoriya Anizotropnykh Obolochek" Moscow, State Publishing House for Phys. and Math. Lit., 1961
(NASA-TT-F-118) OTS: $6.00

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3. MEMBRANE THEORY OF ANISOTROPIC SHELLS p 61–108 refs (See N64-22804 16-23)
4. SYMMETRICALLY LOADED ANISOTROPIC SHELLS OF REVOLUTION p 109–194 refs (See N64-22805 16-23)
5. ANISOTROPIC CYLINDRICAL SHELLS p 195–276 refs (See N64-22806 16-23)
6. SHALLOW ANISOTROPIC SHELLS p 277–314 refs (See N64-22807 16-23)
7. NEW THEORIES OF ANISOTROPIC SHELLS AND PLATES p 315–396 refs (See N64-22808 16-23)

N64-22802* National Aeronautics and Space Administration, Washington, D.C.
FUNDAMENTAL EQUATIONS OF THE THEORY OF ELASTICITY OF AN ANISOTROPIC BODY IN CURVILINEAR COORDINATES
In its Theory of Anisotropic Shells May 1964 p 1–17 refs (See N64-22801 16-23) OTS: $6.00

Briefly discussed, without proof, are those aspects of the theory of curvilinear coordinates in space to be used in considerations of the theory of anisotropic shells. G.D.B.

N64-22803* National Aeronautics and Space Administration, Washington, D.C.
FUNDAMENTAL EQUATIONS OF THE THEORY OF SHELLS CONSISTING OF AN ARBITRARY NUMBER OF ANISOTROPIC LAYERS
In its Theory of Anisotropic Shells May 1964 p 18–60 refs (See N64-22801 16-23) OTS: $6.00

Fundamental equations of the theory of shells consisting of an arbitrary number of anisotropic layers are examined in terms of basic concepts, initial relationships, and hypotheses; displacements and deformations; equations of continuity of deformations of the coordinate surface; stresses in layers; conditions of contact of adjacent layers; internal forces and moments; equilibrium equations; potential energy of deformation; elasticity relationships; and boundary conditions. G.D.B.

N64-22804* National Aeronautics and Space Administration, Washington, D.C.
MEMBRANE THEORY OF ANISOTROPIC SHELLS
In its Theory of Anisotropic Shells May 1964 p 61–108 refs (See N64-22801 16-23) OTS: $6.00

General premises and initial relationships in the membrane theory of single-layer isotropic shells are presented. These are further developed in terms of applicability, symmetrically loaded shells of revolution calculation examples, cylindrical shells, laminar shells, and boundary conditions. G.D.B.

N64-22805* National Aeronautics and Space Administration, Washington, D.C.
SYMMETRICALLY LOADED ANISOTROPIC SHELLS OF REVOLUTION
In its Theory of Anisotropic Shells May 1964 p 109–194 refs (See N64-22801 16-23) OTS: $6.00

Symmetrically loaded anisotropic shells of revolution are discussed from the viewpoint of initial relationships and equations, reduction of equations, asymptotic integration, internal forces, moments, stresses, displacements, long shells of revolution, and anisotropic cylindrical shells of revolution reinforced by lateral ribs. G.D.B.

N64-22806* National Aeronautics and Space Administration, Washington, D.C.
ANISOTROPIC CYLINDRICAL SHELLS
In its Theory of Anisotropic Shells May 1964 p 195–276 refs (See N64-22801 16-23) OTS: $6.00

Basic premises, initial relationships, and equations for anisotropic shells are given. The paper also discusses a system of differential equations of solution in displacements, cylindrical shells consisting of an arbitrary number of orthotropic layers, and other considerations. G.D.B.

N64-22807* National Aeronautics and Space Administration, Washington, D.C.
SHALLOW ANISOTROPIC SHELLS
In its Theory of Anisotropic Shells May 1964 p 277–314 refs (See N64-22801 16-23) OTS: $6.00

Various aspects of anisotropic shells are discussed, including shells consisting of an odd number of homogeneous anisotropic layers, symmetrically arranged relative to the median surface, and integration of the equations of solution in the theory of extremely shallow orthotropic shells. G.D.B.

N64-22808* National Aeronautics and Space Administration, Washington, D.C.
NEW THEORIES OF ANISOTROPIC SHELLS AND PLATES
In its Theory of Anisotropic Shells May 1964 p 315–396 refs (See N64-22801 16-23) OTS: $6.00

New theories of anisotropic shells and plates are presented, such as theories of bending of a plate possessing cylindrical anisotropy, an anisotropic plate considering transverse shear, extremely shallow orthotropic shells, and extremely shallow laminar orthotropic shells. G.D.B.

N64-22859 California U., Berkeley Lawrence Radiation Lab.
GAMMA-RAY-DETECTION EFFICIENCY AND IMAGE RESOLUTION IN SODIUM IODIDE
Hal O. Anger and Donald H. Davis *In its* Biol. and Med. [1963] p 86-90 refs Submitted for Publication (See N64-22851 16-16) OTS: $2.75

Photoelectric, Compton, and photopeak efficiencies are calculated at several gamma-ray energies for large flat sodium iodide crystals in which the thickness ranges from 1/8 to 2 in.

In addition, the loss of position resolution by gamma-ray scattering within the scintillator is calculated because of its importance in the design of gamma-ray imaging devices such as the scintillation camera. An examination of the data shows the advantage of using low-energy gamma rays for imaging whenever possible. These gamma rays are efficiently detected by solid sodium iodide scintillators 1/2-in. thick with little loss of position resolution from multiple scattering of gamma rays in the scintillator. In the higher energy range, a choice must be made between a thin scintillator with its relatively good position resolution and low detection efficiency, or a thick crystal with higher detection efficiency and less satisfactory resolution. Author

N64-22867* California U., Berkeley Lawrence Radiation Lab.
CHARACTERISTICS AND INTENSITY PROFILE OF A HIGH-ENERGY-PROTON BEAM AFTER SCATTERING IN A THICK TARGET
Roger Wallace, Kenneth Kase, and Charles A. Sondhaus *In its* Biol. and Med. [1963] p 136–140 refs (See N64-22851 16-16)
(Sponsored by NASA and AEC) OTS: $2.75

Calculations are made and graphs are presented of the intensity of the emergent beam of high-energy protons from thick targets of lead, copper, aluminum, and carbon. Because theory predicts the smallest secondary particle flux in graphite, and also because of the higher remanent intensity predicted for beams scattered by graphite, it was chosen for the primary-beam scattering target for large-animal whole-body irradiation at high energy with the 184-in. cyclotron. D.E.W.

N64-22877 Joint Publications Research Service, Washington, D.C.
RECENT THEORETICAL DEVELOPMENTS IN ELEMENTARY PARTICLE PHYSICS
Chu Hungyuan *In its* Transl. on Communist China's Sci. and Technol., No. 87 26 May 1964 p 1–20 refs (See N64-22876 16-01) OTS: $1.25

Research done on elementary particle theory in the People's Republic of China since 1960 is discussed. Facilities, personnel, and projects are briefly described, and a bibliography of Chinese physicists is given. Evidence is given to the effect that Chinese workers are familiar with recent developments of foreign scientists, and that Chinese physicists are doing research along similar lines. G.D.B.

N64-22878 Joint Publications Research Service, Washington, D.C.
THEORY OF THE ELECTRONIC STRUCTURE OF ORGANIC MATTER
T'ang Yuch'i *In its* Transl. on Communist China's Sci. and Technol., no. 87 26 May 1964 p 21–46 (See N64-22876 16-01) OTS: $1.25

This article emphasizes the quantum theory of covalent bonds, in an effort to clarify the related quantum effect; the foundation thus laid, an analysis of resonance theory is discussed. The principles of bonding-model variations and the nature of resonance are presented. G.D.B.

N64-22912 Naval Ordnance Lab., Corona, Calif Research Dept.
AN INSTRUMENT FOR MEASURING THE SPECTRAL EMITTANCE OF A SOLID IN THE INFRARED FROM 16 TO 45 MICRONS AT LOW TEMPERATURES
D. L. Stierwalt, D. D. Kirk, and J. B. Bernstein 15 Aug. 1963 15 p
(NOLC-589, AD-419021)

As part of a continuing research project for measuring the emittance of solids, a Beckman IR-3 spectrophotometer has been modified. This modification permits the measurement of spectral emittance of solids in the 16μ to 45μ region in the temperature range between 77° and 473° K. Author

N64-22926 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ATOMIC ENERGY (SELECTED ARTICLES)
V. K. Bogatyrev 22 Jan. 1963 14 p refs Transl. into ENGLISH of 2 Articles from Atomnaya Energ. (Moscow), v. 13, no. 1, 1962 p 68–70, 70–72
(FTD-TT-62-1639/1+2+4; AD-298236)

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1. AN APPROXIMATION FORMULA FOR CALCULATING THE GEOMETRICAL PARAMETER OF HOMOGENEOUS BODIES OF ARBITRARY SHAPE V. K. Bogatyev p 1–5 refs (See N64-22927 16-23)
2. USE OF THE ALBEDO METHOD IN EXAMINING THE INTERACTION OF SUBCRITICAL SYSTEMS V. K. Bogatyev p 6–11 refs (See N64-22928 16-23)

N64-22927 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AN APPROXIMATION FORMULA FOR CALCULATING THE GEOMETRICAL PARAMETER OF HOMOGENEOUS BODIES OF ARBITRARY SHAPE
V. K. Bogatyrev *In its* Atomic Energy (Selected Articles) 22 Jan. 1963 p 1–5 refs (See N64-22926 16-23)

It is possible, on the basis of available experience in such calculations, to prove that, for homogeneous bodies of arbitrary shape and without reflectors, the following formula gives satisfactory results, error never exceeding 4%: $x = 1/4 \int_{\Omega} d\Omega/r(\Omega)$ A.W.

N64-22928 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
USE OF THE ALBEDO METHOD IN EXAMINING THE INTERACTION OF SUBCRITICAL SYSTEMS
V. K. Bogatyrev *In its* Atomic Energy (Selected Articles) 22 Jan. p 6–11 refs (See N64-22926 16-23)

The interaction in air of subcritical systems of spherical and cylindrical geometrics may be described with the aid of the albedo method if each of the interacting bodies is close to the critical state. A.W.

N64-22947 California U., Livermore Lawrence Radiation Lab.
MIXING AND CHEMICAL REACTIONS IN TURBULENT FLOW REACTORS
Roger Norris Keeler (Ph.D. Thesis) Jun. 1964 202 p refs
(Contract W-4705-ENG-48)
(UCRL-7852) OTS: $3.00

Mixing and a rapid, second-order irreversible chemical reaction were studied in a turbulent chemical flow reactor, using a high-sensitivity microconductivity probe to detect

changes in concentration. Results of the turbulent mixing experiments are compared with the latest theoretical predictions. Using the mathematical theory of Toor, it is shown experimentally that data on the mixing of a passive scalar additive in a nonreactive system may be used accurately to predict the yield of a rapid, irreversible second-order reaction when the hydrodynamics and initial conditions on mixing for the reactive system are identical to those of the nonreactive system. Increasing the bulk average concentration of one reactant is shown to have a strong effect on the overall reaction yield.
Author

N64-23013 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy)
OPTICAL CALCULATIONS OF THE TRANSPORT OF ACCELERATED POSITRONS IN A NON-PLANAR WAVE IN THE FRASCATI *LINAC* [CALCOLI PER L'OTTICA DI TRANSPORTO NEL *LINAC* DI FRASCATI DI POSITRONI ACCELERATI DA UN'ON DA NON PIANA]
E. Ferlenghi and L. Mango 9 Mar. 1964 15 p ref in ITALIAN *Its* Nota Interna 233
(LNF-64/5)

The nonlinear transport of nonplanar waves in a positron accelerator has been observed with optical instruments. The results of the observations are presented in tabular form, showing the magnetic field generated, the distance traveled by the waves, and the emf values for the fields.
Trans. by D.E.R.

N64-23020 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy)
THE EFFECT OF ERRORS IN THE CONSTRUCTION OF MAGNETIC COMPONENTS OF AN ACCELERATOR WITH AN ANALYSIS OF THEIR FUNCTIONS [EFFETTO DEGLI ERRORI NEGLI ELEMENTI DELLA STRUTTURA MAGNETICA DI UNA MACCHINA ACCELERATRICE A FUNZIONI SEPARATE]
L. Mango 16 Jun. 1964 45 p refs In ITALIAN *Its* Nota Interna 231
(LNF-64/1)

The effects of errors in the construction of the magnetic components of an accelerator are analyzed functionally. Included are the following: (1) casual errors—errors in defining the gradients, alignment, and azimuth of the magnetic field; (2) systematic errors—persistent, recurring errors in defining the parameters of the field; and (3) nonlinear effects of these errors. The mathematical equations for the effects of these errors are solved.
Trans. by D.E.R.

N64-23021 Wisconsin U., Madison Theoretical Chemistry Inst.
AN EXPANSION OF BINARY COLLISION PHASE SHIFTS IN POWERS OF h
C. F. Curtiss 16 Jan. 1963 18 p refs
(NSF G-9204; NSF G-19635)
(WIS-TCI-9, Ser. 2)

The phase shifts in binary collisions are expressed as series in increasing powers of Plancks constant, h. The series begins with a term in h^{-1} and contain all odd powers. Recursion relations are developed that lead to an expression for an arbitrary term in the series. The results apply to an arbitrary interaction potential function, for which any odd number of classical turning points may arise.
Author

N64-23022 Library of Congress, Washington, D.C. Aerospace Information Div.
RADIO-FREQUENCY MASS SPECTROMETRY, COMPREHENSIVE REPORT
11 Jun. 1964 52 p refs
(AID-P-64-39; AD-601335) OTS: $5.60 ph

Descriptions and specifications are presented of Soviet RF mass spectrometers. Some of the devices were not initially designed for upper-atmosphere investigations, but are included as links in the development of types specifically suited to high-altitude research. The devices are RMS-M, the Doyle syn patent, RMS-1, MKh-6401, MS-"Pokhunkov," and MKh-6403 and MKh-6405. Studies of the ionized components of the upper atmosphere are discussed on the basis of experiments with Sputnik III and rocket experiments from 1957–1962. Studies of the neutral components of the upper atmosphere are based on data of rocket experiments from 1959–1961.
E.K.

N64-23023 Library of Congress, Washington, D.C. Aerospace Information Div.
SOVIET FAST-PULSED RESEARCH REACTOR (IBR) SUMMARY OF DATA
12 Jun. 1964 16 p refs
(AID-P-64-40; AD-601316) OTS: $1.60 ph

The fast-pulsed Soviet research reactor IBR is a pulsed neutron source designed for physical investigations using time-of-flight techniques. Low mean reactor power (1 kw) allows sophisticated and economy-of-nuclear-fuel experiments to be made. This report describes, illustrates, and furnishes statistical data on the IBR.
G.D.

N64-23045* National Aeronautics and Space Administration, Washington, D.C.
THE MOTION OF CHARGED PARTICLES IN THE FIELD OF A MAGNETIC DIPOLE, WITH ALLOWANCE FOR ENERGY DISSIPATION [DVIZHENIYE ZARYAZHENNYKH CHASTITS V POLE MAGNITNOGO DIPOLYA S UCHETOM DISSIPATSII ENERGII]
V. M. Vakhnin, G. A. Skuridin, and I. N. Shvachunov Mar. 1964 33 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 1, no. 3, Nov.–Dec. 1963 p 414–435
(NASA-TT-F-8830)

This article discusses the motion of charged particles in a magnetic field, in conservative approximation and with allowance for dissipative perturbations, in the case of three idealized schemes: (1) a magnetic dipole in the absence of an external magnetic field; (2) a magnetic dipole in space with a homogeneous magnetic field parallel to the intensity vector of the magnetic field of the dipole in its equatorial plane; and (3) a magnetic dipole in space with a homogeneous magnetic field antiparallel to the intensity vector of the magnetic field of the dipole in its equatorial plane. A study is made in the equatorial plane of the dipole. The analysis of the motion of charged particles in the magnetic field was made by the phase-plane method in conservative approximation; this made it possible to observe a number of critical trajectories and to obtain a qualitative picture of the influence of kinetic energy losses upon the form of the trajectories. These losses were considered as small dissipative perturbations of conservative approximation.
Author

N64-23050* National Aeronautics and Space Administration, Washington, D.C.

EFFECTIVE COLLISION CROSS SECTIONS IN SCATTERING EXPERIMENTS [EFFEKTIVE STOSSQUERSCHNITTE BEI STREUVERSUCHEN]

K. Berkling (IBM Deutschland), R. Helbing, K. Kramer, H. Pauly, Ch. Schlier et al P. Toschek 12 Oct. 1961 49 p refs Transl. into ENGLISH from Z. Physik (Berlin), no. 166, 1962 p 406-428

(NASA-TT-F-8880)

Scattering experiments are often not performed with the ideal setup consisting of a monochromatic beam and target particles at rest. This is, for instance, never the case in molecular beam scattering, which is of primary interest in this paper. Two arrangements are normally employed, one consisting of a gas chamber as target (case a), the other of a crossed beam, generally at right angles to the incoming beam (case b). In both cases the scattering particles have a Maxwellian velocity distribution. This means that in any such experiment an effective cross section is measured that is an integral over cross sections for different collision velocities. Other similar integrals are needed if one works with polarized beams and takes into account the fact that the cross section is angle-dependent. A third type of integral is required when the primary beam is not monochromatized and when one has to average over its velocity distribution too. The functions needed to interpret scattering experiments of all the types mentioned are given in this paper, as well as a table of values for the 24 most important of these functions. Author

N64-23058 Argentina Comision Nacional de Energia Atomica, Buenos Aires

A METHOD OF PRODUCTION OF IODA-131 BY PARTITION OF THE OXIDES OF IRRADIATED URANIUM [UN METODO DE PRODUCCION DE IODO-131 A PARTIR DE OXIDOS DE URANIO IRRADIADOS]

S. Abrashkin (Israel AEC) and R. Radicella 1963 11 p refs In SPANISH; ENGLISH summary *Its* Informe no. 101

A procedure to obtain fission product ^{131}I by dry distillation from uranium oxides is described. The distillation of ^{131}I from UO_2 and UO_3 at different temperatures was studied, and a yield of 75% was found by heating amorphous UO_3 for 10 hours in air at 700°C. In order to avoid ruthenium contamination, the gases from the distillation were passed through iron chips heated at 700°C, and a quantitative retention of ruthenium was observed. The radioactive purity of the ^{131}I preparation was greater than 99.9%. Author

N64-23061 Atomic Energy Commission, New Brunswick, N.J.

SEMIANNUAL PROGRESS REPORT FOR THE PERIOD JULY 1963-DECEMBER 1963

A. R. Eberle et al Jun. 1964 48 p refs

(NBL-210) OTS: $1.25

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4. BORON SCRAP RECOVERY BY PYROHYDROLYSIS A. R. Eberle, L. J. Pinto, and M. W. Lerner p 7 ref

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6. THE SPECTROCHEMICAL ANALYSIS OF IMPURITIES IN BORON METAL H. G. Yuster and H. R. Mullin p 21-28 refs

7. MOLYBDENUM AND TECHNETIUM IN HYDROLYZED URANIUM HEXAFLUORIDE Mary R. Clickner p 29-33 refs

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N64-23062 Atomics International, Canoga Park, Calif.

ANALYSIS OF POWER RAMPS WITH AN ANALOG COMPUTER

W. J. Carlson and A. L. Gunby 15 Jun. 1964 33 p refs

(Contract AT(11-1)-GEN-8)

(NAA-SR-7929) OTS: $0.75

Analysis of power ramps on the Sodium Reactor Experiment by use of the analog computer is a fast, accurate, and simple method for determining the heat-transfer parameters. This method requires a minimum of reactor time. Results on the SRE Core II are reproducible to ±5%, showing a prompt power coefficient of reactivity of −2.05 ¢/mwt at 1,000 gal/min main-primary flow. The single-lag temperature feedback approximation is adequate for most operating conditions of the reactor. Author

N64-23064 European Atomic Energy Community, Brussels (Belgium)

CONTRIBUTION TO THE THEORY OF THE PULSED NEUTRONS TECHNIQUE APPLIED TO FAST MULTIPLYING SYSTEMS

F. Storrer and M. Stievenart 1964 22 p refs Presented at the Colloq. on Progress in the Theory of Reactors, Karlsruhe, Germany, 23-24 Apr. 1964

(Contract Euratom-006-62-1 RAAF)

(EUR-593.e) Available from Belgian Am. Bank and Trust Co., N.Y., Account no. 121.86: 40 Belg. Fr.

The main object of this paper is to present a novel approach to the theory of the pulsed neutrons technique, when applied to fast neutron subcritical multiplying assemblies. In such a system, an increase of neutron energy can only be the result of fission, and in such a process, the spectrum of the emerging neutrons is independent of the energy of the incident neutron, making it possible to study independently the evolution of the neutrons in each generation, which is similar to that in a nonmultiplying medium, and which is easier to treat since the energy of the neutron can only decrease. Transfer functions are then obtained that can be combined to obtain the overall evolution of the neutron population in the multiplying system. This theory is then applied to some practical examples and particularly to Godiva for which experimental results are available. A similar approach can be used for the analysis of static problems, particularly the exponential experiment. Author

N64-23063 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CALCULATION OF THE KINETIC ENERGY OF A SYSTEM OF LINKED BODIES
M. Z. Litvin-Sedoy (Moscow State U.) *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 16-25 refs (See N64-23066 16-03)

The kinetic energy, the total energy level, and possible mechanisms of controlling self-motive systems of solid bodies of variable mass, connected to each other in some manner, are discussed. The mathematics for a simple system of this type is demonstrated, and reference is made to works dealing with more complex systems. D.E.R.

N64-23089 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYMMETRICAL MONO-FREQUENCY FORCED OSCILLATIONS IN NONLINEAR AUTOMATIC CONTROL SYSTEMS
V. V. Pavlov *In its* Automation 14 Feb. 1963 refs p 88-91 (See N64-23080 16-17)

The application of a given equation in examining forced monofrequency oscillations in systems with a vital nonlinear member is discussed, and the importance of a corrective member—the concrete form of the linearization coefficient—in solving for concrete cases is stressed. M.P.G.

N64-23106 Queens Coll., Flushing, N.Y.
THE SCHWARZSCHILD METRIC AND WHITEHEAD THEORY OF GRAVITATION
A. L. Harvey Apr. 1964 3 p refs
(Grant Nonr(G)-00055-64)
(TR-1; AD-438883)

This is a discussion of the gravitation theory and concerns the exact nature of the relationship between Whitehead's theory and Einstein's theory. The Heisenberg and Schrödinger formulations of quantum mechanics are examined to shed light on this question. G.D.B.

N64-23138 Chicago U., Ill.
THE NATURE AND INTERACTIONS OF HIGH ENERGY FUNDAMENTAL PARTICLES Final Scientific Report, Period Ending Jun. 30, 1963
R. W. Thompson [1963] 21 p
(Grant DA-ARO(D)-31-124-6342)
(AROD-2427-1; AD-427326)

The nature and interactions of high-energy fundamental particles are discussed in terms of the large magnetic Wilson chamber, the photon detector, the Dolirotin ionization calorimeter, magnet coils, iron magnet yoke, rapid exhaust valves, electronic flashtube light sources, and spark chamber. G.D.B.

N64-23140 Thiokol Chemical Corp., Denville, N.J. Reaction Motors Div.
KINETICS OF CONDENSATION FROM THE VAPOR PHASE Annual Summary Report
Welby G. Courtney Apr. 1964 15 p refs
(Contract Nonr-4154(00))
(Rept.-5515-F; AD-434286)

The theory of homogeneous nucleation was reexamined. It was concluded that Kuhrt's theory for cluster formation in monoatomic vapor, which conserves degrees of freedom during nucleation, is procedurally correct. The Kuhrt approach was extended to polyatomic vapors, giving correction factors to the classical rate of nucleation of about 10^4, 10^5, and 10^9 for a monoatomic, linear, and nonlinear polyatomic condensing molecular, e.g., argon, nitrogen, and water, respectively. The theoretical rate of condensation of water vapor was examined in detail. An experimental study of the rate of nucleation of MgO particles from Mg vapor and O_2 was unsuccessful because the rate of condensation was much faster than the rate of mixing of the two vapors. Recent work was oriented toward comparing the theoretical rate of condensation of water with experimental pressure-time data previously obtained in a cloud chamber and measuring the experimental rate of water condensation in the rarefaction zone in a shock tube. The condensation of NH_4Cl from an equilibrated NH_3-HCl vapor mixture in the shock tube will be investigated in the near future. Author

N64-23143 Harvard U., Cambridge, Mass. Cruft Lab.
SURFACE-WAVE PROPAGATION ALONG A FERRITE ROD Scientific Report No. 3 (Series 3)
T. F. Tao 20 Mar. 1963 156 p refs
(Contract AF 19(628)-2406)
(AFCRL-63-569; AD-600465)

Measurements are made of the HE_{11} surface-wave mode in this study of the properties of a surface wave propagating along a magnetized ferrite rod. The d.c. magnetic field measurements, measurements of guided wavelength, of attenuation, and of the radial field are presented. The theoretical calculation of the guided wavelength agreed with the measured results. E.C.

N64-23152* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A THEORETICAL BASIS FOR MECHANICAL IMPEDANCE SIMULATION IN SHOCK AND VIBRATION TESTING
A. J. Oh *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 47-53 refs (See N64-23151 16-01)

Fundamental and useful mathematical relations for impedance are given for the analysis, control, and simulation of mechanical structure that can be considered as one-dimensional linear-passive systems. The validation of these expressions in the application to impedance control and simulation is approached primarily from analytical considerations, with general theories of application summarized. Author

N64-23154 General Electric Co., New York, N.Y.
SHOCK ENVIRONMENTS GENERATED BY PYROTECHNIC DEVICES
H. J. Roberge and J. Rybacki *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 73-81 refs (See N64-23151 16-01)

A testing program to study shocks generated by pyrotechnic separation devices is described, and typical shock response data are presented. Inadequacies of existing instrumentation, simulation, and analysis techniques are discussed. Remedial measures that were employed to negate the shock effects are described. Author

N64-23157* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECTS OF A SPRING CLEARANCE NONLINEARITY ON THE RESPONSE OF A SIMPLE SYSTEM
J. P. Young *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 133-140 refs Paper Not Presented at Symp. (See N64-23151 16-01)

This investigation was performed analytically through the use of the Ritz averaging method and by simulation on an analog computer. The results of the Ritz averaging method are compared with exact results based on the use of the linear differential equations that apply to the individual segments and show good agreement outside the superharmonic response region. Both the mass displacement and the mass acceleration frequency response functions were determined, with considerable effort devoted to defining the superharmonic response characteristics of this simple system. The superharmonic response is shown to radically modify the system response in the low frequency ratio range. Based on these displacement and acceleration frequency response functions, the remaining part of the investigation was devoted to comparing the maximum spring load and the maximum mass acceleration with corresponding response parameters for a linear system produced by eliminating the clearance. This comparison is presented as a ratio of nonlinear to linear response vs frequency ratio for both the forced mass and the moving foundation cases. Author

N64-23172 Comitato Nazionale per l'Energia Nucleare, Rome (Italy) Lab. Nazionali di Frascati
PROPAGATION ON PHENOMENA IN A SCINTILLATION CHAMBER [FENOMENI PROPAGATIVI NELLE CAMERE A SCINTILLA]
M. A. Locci and M. Puglisi 14 Apr. 1964 38 p In ITALIAN *Its* Nota Interna no. 237
(LNF-64/11)

The problem of determining the behavior of the electric field between the plates of a spark chamber as a function of time and position, considering the voltage waves that may propagate between the plates themselves, is discussed. A diagram is presented for the evaluation of the behavior of the spark chamber. In this diagram the voltage is given as a function of position, with time as a parameter. I.v.L.

N64-23208 Purdue U., Lafayette, Ind. School of Aeronautical and Engineering Sciences
QUANTUM THEORY OF VIBRATIONAL ENERGY AND THE EFFECT OF AN ATTRACTIVE POTENTIAL
R. T. Allen and P. Feuer Mar. 1964 38 p refs

A first-order time-dependent perturbation theory is described for the calculation of transition probabilities in the interaction of an atom with an atomic oscillator. The relation of this theory to the theory of distorted waves is discussed. The method is applied to the special case of an interaction potential of the form $V(r) = Ce^{-2Ar} - Ge^{-Ar}$. It is also applied to the calculation of transition probabilities for a diatomic molecule reflected from a solid surface, taking into account the effect of an attractive potential. Author

N64-23219 Los Alamos Scientific Lab., N. Mex.
THEORY OF THE FIREBALL
Hans A. Bethe 17 Jun. 1964 87 p refs
(Contract W-7405-ENG-36)
(LA-3064) OTS: $2.00

The successive stages of the fireball due to a nuclear explosion in air are defined. This paper is chiefly concerned with Stage C, from the minimum in the apparent fireball temperature to the point where the fireball becomes transparent. In the first part of this stage (C I), the shock (which previously was opaque) becomes transparent due to decreasing pressure. The radiation comes from a region in which the temperature distribution is given essentially by the Taylor solution. To supply the energy for the radiation, a cooling wave proceeds from the outside into the hot interior. When this wave reaches the isothermal sphere, the temperature is close to its second maximum. Thereafter, the character of the solution changes; it is now dominated by the cooling wave (Stage C II). The cooling wave eats into the isothermal sphere until this is completely used up. The inner part of the isothermal sphere, i.e., the part that has not yet been reached by the cooling wave, continues to expand adiabatically; it therefore cools very slowly and remains opaque. After the entire isothermal sphere is used up, the fireball becomes transparent and the radiation drops rapidly. Author

N64-23223 Comitato Nazionale per l'Energia Nucleare, Frascati (Italy)
PRODUCTION OF MONOCHROMATIC PHOTONS BY MEANS OF THE DESTRUCTION OF POSITRONS IN LIGHT ELEMENTS [PRODUZIONE DI FOTONI MONOCROMATICI MEDIANTE L'ANNICHILAZIONE DI POSITRONI IN ELEMENTI LEGGERI]
C. Schaerf 1 Jan. 1964 5 p ref In ITALIAN *Its* Nota Interna no. 232
(LNF-64/2)

The production of photons by annihilation of positrons has been studied, and it was found that such monochromatic photons can only be produced in one basic energy band. Such particles have never been produced at energy levels higher than 1 Mev. D.E.R.

N64-23224 Comitato Nazionale per l'Energia Nucleare, Rome (Italy) Lab. Nazionali di Frascati
PHOTOPRODUCTION AND NEUTRAL DECAY MODES OF THE η-PARTICLE
C. Bacci, C. Mencuccini, G. Penso, R. Querzoli, G. Salvini (Rome U., Italy), eeeet al 16 Mar. 1964 36 p refs *Its* Nota Interna no. 234
(LNF-64/6)

This report deals with the neutral decay modes of the η-particle and, in particular, with the results of an experiment conducted to study the photoreduction reaction $\gamma + p \rightarrow \eta + p$ at the 1.1 Gev electron synchrotron. I.v.L.

N64-23242 Bureau of Mines, Reno, Nev.
INFRARED ANALYSES OF GASES PRODUCED DURING MOLTEN SALT ELECTROLYSIS OF METALS
J. L. Johnson, G. H. Cobb, and H. H. Heady [1964] 15 p refs
(RI-6476)

An infrared absorbance technique is described for analyzing anodic gases produced during the electrowinning of uranium, thorium, and rare-earth metals in molten fluorides. Typical components determined qualitatively in a gas sample are CO, CO_2, CF_4, C_2F_6, C_3F_8, COS, CS_2, and SiF_4. About 20 min are required to record and interpret the spectrogram, and report quantitative results for CO, CO_2, CF_4, and SiF_4. The procedure is used for control during electrolysis. Author

N64-23258 Los Alamos Scientific Lab., N. Mex.
RE-EVALUATION OF OPTIMAL PARAMETERS FOR POST-FISSION BETA DECAY
James J. Griffin 15 Jun. 1964 30 p refs
(Contract W-7405-ENG-36)
(LA-2811, Addendum II) OTS: $0.75

An error in a previous calculation is corrected. The two adjustable parameters in the description are reevaluated to

optimize the fit with the corrected version of the theory. Previous qualitative conclusions about the encouraging consistency between the model and the available data remain valid. Quantitative modifications occur in certain extrapolations of the calculation reported earlier. The corrected extrapolations, which supersede earlier results, are presented. Author

N64-23259 Bureau of Mines, Albany, Ore.
HIGH-LEVEL GAMMA-RAY DOSIMETRY AT THE ALBANY COBALT 60 FACILITY
Stephen D. Hill and F. E. Block [1964] 21 p refs
(RI-6465)

The necessity for measuring radiation dose is encountered in studying both the beneficial and damaging effects of ionizing radiation on materials. It is also necessary to know the radiation dose absorbed by the reactants in order to evaluate the efficiency of reactions or processes that are promoted by radiation. Methods including ferrous sulfate, ceric sulfate, and methyl methacrylate chemical dosimeters, ion chamber dosimetry, and an absolute radiation calorimeter were investigated. Isodose curves were constructed for several standard source configurations using the dosimetry techniques that were investigated. Author

N64-23262 Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
GAS FLOW CALCULATIONS FOR FLUIDIZED-BED COATING OF NUCLEAR FUEL PARTICLES
R. L. Pilloton Jun. 1964 58 p refs
(Contract W-7405-ENG-26)
(ORNL-3639)

Calculations of gas flow requirements and of other related parameters in the fluidized-bed process used to coat nuclear fuel particles are presented. These data include the following: volumes and surfaces of spheres for diameters of 50μ to 500μ; number of these spheres in one gram for densities of 2 to 11 g/cm^3; overall densities of coated spheres for initial particle diameters of 50μ to 500μ, initial densities of 8 to 11 g/cm^3, coating densities of 1.0 to 2.2 g/cm^3, and final particle diameters of 100μ to 1,000μ; viscosities of argon, carbon dioxide, helium, and hydrogen for temperatures up to 2,200° C; minimum flows of helium and argon necessary to fluidize nuclear fuel particles at 20° C; coefficients for converting the 20° C minimum fluidization gas flows to high-temperature flows (up to 2,200° C); variation of particle diameter with time for constant weight deposition rate; variation of coating gas flow for constant linear growth of the coating; and comparison of coating time at constant weight deposition rate and at constant coating growth rate. Author

N64-23263 California U., Berkeley Lawrence Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT. 39, JULY–SEPTEMBER 1963
Kenneth C. Crebbin, William L. Everette, Calvin F. Hansen, and Harold W. Vogel 13 Apr. 1964 23 p refs
(Contract W-7405-ENG-48)
(UCRL-11279) OTS: $0.50

The Bevatron provided beam for 86.8% of the scheduled operating time. There was a 4-day shutdown period, including a 24-hr vacuum shutdown. The studies of the beam loss just after injection continued, with no conclusive results. A new primary experiment started this quarter, using the external proton beam. There were some changes made in the main a.c. power distribution to correct for line fluctuations caused by pulsed equipment at the Bevatron. Author

N64-23267 Los Alamos Scientific Lab., N. Mex.
INTEGRALS OF BETA SPECTRA
George P. Ford and Darleane C. Hoffman 4 Jun. 1964 31 p ref
(Contract W-7405-ENG-36)
(LA-3066) OTS: $0.75

Integrals of β^- spectra for allowed transitions were calculated for all atomic numbers from 10 to 109 and for maximum kinetic energies from 0.1 to 5.5 Mev at 0.1 Mev intervals. The results were tabulated and can be used for a nongraphical determination of relative abundances of β^- spectrum components from their Fermi-Kurie plots. Author

N64-23270 Battelle Memorial Inst., Columbus, Ohio
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING MARCH, 1964
Russell W. Dayton and Ronald F. Dickerson 1 Apr. 1964 63 p refs
(Contract W-7405-ENG-92)
(BMI-1668(Del.)) OTS: $1.50

This is a series of articles on the progress achieved in civilian application of atomic energy. Discussed are reactor materials and components, fuels, radioisotopes, radiation, coated-particle fuel materials, fission-product diffusion, thermal conductivity, and a tracer system for in-place filter evaluation. G.D.B.

N64-23277 Basel U. (Switzerland)
ANALYSIS OF THE SPECTRUM OF THE NITRIC OXIDE MOLECULE
E. Miescher Mar. 1964 4 p refs
(Contract AF-EOAR-63-109)
(AFCRL-64-391; AD-600389)

Progress in the analysis of the NO^- absorption spectrum is reported. Three isotopes of the molecule are studied. New energy levels and their interactions are discussed. Author

N64-23285 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MAGNETIC LOGICAL ELEMENTS
V. S. Podlipenskiy 5 Mar. 1963 5 p Transl. into ENGLISH from Soviet Patent No. 145067, 13 Feb. 1961 p 1-3
(FTD-TT-62-1502/1+2; AD-400536)

This paper describes a magnetic logical element that contains a core with a rectangular hysteresis loop that has controlling and functional windings. Diode, resistance, and a.c. voltage sources are connected to each circuit in series. For the purpose of reducing the amount of equipment and increasing the rapid action during execution of operation "I" with negation, the winding has two sequential inputs. G.D.B.

N64-23326 Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM
R. M. Adams and M. Weber 15 Jun. 1964 121 p refs
(Contract W-31-109-ENG-38)
(ANL-6904) OTS: $2.50

The current status of the following areas is reported: (1) boiling water reactors; (2) liquid-metal-cooled reactors; (3) general reactor technology; (4) advanced systems research and development; and (5) nuclear safety.

N64-23337 New York U., N.Y.
DIFFRACTION OF A HIGH-FREQUENCY PLANE ELECTROMAGNETIC WAVE BY A PERFECTLY CONDUCTING CIRCULAR DISC
D. S. Jones Jul. 1963 65 p refs
(Contract AF 19(604)-5238)
(EM-189; AFCRL-63-369; AD-436111)

A method already developed for the diffraction of scalar waves by a circular disc is generalized so as to be applicable to the diffraction of an electromagnetic wave. The generalization leads, in a straightforward manner, to an asymptotic development of the current density on the disc at high frequencies. The principal complication that arises is in solving three simultaneous linear equations for three constants that occur in the method of solution. Detailed calculations are given for a normally incident plane wave. Author

N64-23338 Naval Civil Engineering Lab., Port Hueneme, Calif.
DOSE MEASUREMENTS FOR NEUTRON STREAMING IN DUCTS
D. R. Doty 26 Mar. 1964 40 p refs
(R-282; AD-436183)

The purpose of this report is to describe an operating facility and present some preliminary findings concerning the streaming of neutrons in ducts of protective shelters. The experimental results are compared to a simplified theoretical treatment, using the albedo approach. Dose measurements were obtained in a 3-X 3-ft concrete duct for thermal, 2.5-Mev, and 14.7-Mev neutrons using a 12-in. spherical energy-independent dosimeter. In the second leg, for all energies, the dose was found to have a higher dropoff than the theory predicted. Reasons for the discrepancy are examined, and a comparison of effective albedos is made for various energies. Author

N64-23354* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EFFECTS OF NUCLEAR RADIATION AND CRYOGENIC TEMPERATURES ON ENGINEERING MATERIALS
E. C. Mc Kannan and R. L. Gause N.Y., AIAA [1964] 20 p refs
Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-361) AIAA: $0.50 members, $1.00 nonmembers

Space vehicles must be capable of operating for extended periods of time in hostile environments. Therefore, a prime consideration in the design of space vehicles is the capability of component materials to function properly after being exposed to the environment(s) expected during the mission. In nuclear-powered spacecraft, the hostile environment consists principally of nuclear radiation, vacuum, and cryogenic temperatures. This paper is concerned with the evaluation of the changes that occur in the physical and mechanical properties of engineering materials during separate and simultaneous exposure to two of these environments, nuclear radiation and cryogenic temperatures. Data obtained from the investigation of the combined effects of radiation and cryogenic temperatures on nonmetallic materials are given, and they include the results of mechanical and physical tests made on various materials during simultaneous exposure to the specified environments. Materials discussed in this paper are representative of those most likely to be used in nuclear-powered spacecraft, and they were selected from the categories of structural adhesives, structural laminates, thermal insulations, electrical insulations, and thermal control coatings. The response of these materials to the environments are discussed according to chemical class, e.g., polyurethanes and epoxies. Author

N64-23372* National Aeronautics and Space Administration, Washington, D.C.
INFRASONIC WAVES FROM THE AURORAL ZONE
Kaichi Maeda and Tomiya Watanabe (British Columbia U.) Washington, NASA, Jun. 1964 44 p refs
(NASA-TN-D-2138) OTS: $1.25

Pulsating aurorae are proposed as a source of the infrasonic waves associated with geomagnetic activity reported by Chrzanowski et al. One of the most plausible generation mechanisms of these long-period pressure waves is the periodic heating of the air around 100 km, corresponding to the auroral coruscation reported by Campbell and Rees. To show the energetic relationship between source input and pressure change at sea level, some theoretical calculations are performed by using a simple model of auroral distribution in the isothermal atmosphere. Author

N64-23380 California U., Berkeley Lawrence Radiation Lab.
AN ELEMENTARY (?) GUIDE TO THE ELEMENTARY (?) PARTICLES
Arthur Rosenfeld May 1964 20 p
(Contract W-7405-ENG-48)
(UCRL-11100) OTS: $0.50

In this series of articles, the recent history of the revolution that has been taking place in the field of high energy physics (the "population explosion" in subatomic particles) is traced. An analysis of experimental evidence accumulated by present-day physicists on "elementary" particles is presented. These newly observed particles and resonances are often being referred to as various "states" of the strong interaction. R.T.K.

N64-23389 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THERE ARE SEVEN ELEMENTS IN THE WORLD
M. Vasil'yev and K. Stanyukovich 20 Feb. 1963 284 p Transl. into ENGLISH of the Book "V Mire Semi Stikhiy" Moscow, Izd. "Molodaya Guardiya", 1961 p 1–255
(FTD-TT-62-960/1+2; AD-298778)

This book describes man's relationship to the universe and methods of study that have been used to determine the nature of the various elements. The chapters deal with the substance of the universe (three submissive elements), plasma (the fourth state of matter), intangible matter, the time paradox, and gas dynamics. The history of the universe with man as its ruler is discussed. E.C.

N64-23408 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NONLINEAR APERTURE CORRECTION
G. V. Braude and I. N. Isayeva 12 Feb. 1962 16 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), no. 12, 1961 p 3–10
(FTD-TT-62-1726/1+2; AD-401595)

Discussed is a method of nonlinear aperture correction, equivalent in its action to the distribution of the signal into several levels. Correction of linear distortions of the television tract, especially aperture correction, leads to a rise in the level of fluctuation interference in the TV tract. Ways to combat this limitation are presented. G.D.B.

N64-23413 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METHOD OF OBTAINING IMPACT DEFORMING FORCES BY MEANS OF ELECTROHYDRAULIC SHOCKS
L. A. Yutkin and L. I. Gol'tsova 28 Mar. 1963 5 p Transl. into ENGLISH from Soviet Patent No. 142502, 24 May 1962 p 1-3
(FTD-TT-63-25/1+2; AD-402451)

Methods are described for obtaining impact deforming forces by means of electrohydraulic shocks effected in a liquid medium. For forging, stamping, lamination, beading, riveting, cleaning, forcing in, bending, breaking, cutting, and other kinds of material processing, impact deforming forces are obtained by electrohydraulic shocks producible in a liquid-filled cylinder, or a chamber with a piston or membrane. This takes up the force of shocks and transmits them directly, or through a suitable instrument connected to them, to an object to be deformed. The reverse displacement of the piston or membrane is accomplished by atmospheric pressure on slamming the cavitation void. G.D.B.

N64-23418 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AN ION SOURCE FOR PROTON-ACCELERATOR INJECTORS
Heinz Werner 14 Mar. 1963 6 p Transl. into ENGLISH from Soviet Patent No. 146891, 28 May 1960
(FTD-TT-63-68/1+2+4; AD-400546)

This report deals with a piece of equipment that eliminates the common deficiencies in the standard ion source for proton-accelerator injectors. By using a radially magnetized permanent magnet, together with a single airgap equipped with magnetic shunts that regulate the magnetic field of the lens, the reliability of source operation and facility of regulation are increased. G.D.B.

N64-23525* Maryland U., College Park Inst. for Molecular Physics
RELAXATION EFFECTS IN THE TRANSPORT PROPERTIES OF A GAS OF ROUGH SPHERES
L. Monchick, K. S. Yun, and E. A. Mason (APL) 12 Sep. 1962 17 p refs
(Grant NsG-5-59)
(NASA-CR-56553; IMP-NASA-32) OTS: $1.60 ph

The rough sphere model is investigated in some detail from the point of view of the formal kinetic theory of polyatomic molecules. The purpose is to clarify the sources of some discrepancies between the known results for the transport properties of a rough sphere gas and the results of an approximate treatment of the formal kinetic theory, in which the corrections for inelastic collisions are given in terms of relaxation times. It is found that the deviations of the transport coefficients of rough spheres from those of smooth spheres can be understood in first approximation as the result of two effects: an enhancement of the backward and sideward scattering of rough spheres over that for smooth spheres, and an apparent resonant exchange of internal energy when two rough spheres collide. Since these effects are, for the most part, peculiar to rough spheres, it is concluded that the deviations found between the rough sphere model and the approximate theory are not to be expected for real molecules. Author

N64-23552 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE PRINCIPLES OF D'ALEMBERT-LAGRANGE AND HOLDER AND THE EQUATIONS OF MOTION OF MECHANICAL SYSTEMS WITH NON-HOLONOMIC COUPLINGS
V. V. Dobronravov *In its* Mech. 28 Aug. 1963 p 34-46 refs (See N64-23551 16-01)

The equations of motion, regardless of the nature of the relationships (rheonomic, nonholonomic, etc.), can be derived by a simplification of the D'Alembert–Lagrange principle known as "Holder's principle." Certain general equations based on these and other applicable principles are presented together with their solutions, for all categories of nonholonomic relationships. A.W.

N64-23554 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE RELATIONSHIPS BETWEEN COMPOUND QUANTITIES AND THEIR ELEMENTS
V. V. Dobronravov *In its* Mech. 28 Aug. 1963 p 57-64 refs (See N64-23551 16-01)

It is possible to obtain generally nonlinear relationships between quantities and their elements by reducing them to their component terms. Presented are a number of relationships of similar structure between geometrical and kinematic elements of a particle as it moves in an elliptic orbit, with investigation limited to quantities in three-dimensional spaces. A.W.

N64-23555 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE QUESTION OF THE BEHAVIOR OF CERTAIN GYROSCOPES
S. S. Tikhmenev *In its* Mech. 28 Aug. 1963 p 65-71 (See N64-23551 16-01)

The capacity of a gyroscope, when put into motion upon a rough surface, to overturn itself was observed during the testing of a device consisting of a base in the form of a truncated sphere and of a cylinder. Similar behavior will be inherent to systems of similar construction if they are given high angular velocity around symmetrical axes. A.W.

N64-23559 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE PROBLEM OF THE APPLICABILITY OF VOLTERRA'S DYNAMICS EQUATIONS TO NON-HOLONOMIC SYSTEMS
G. N. Knyazev *In its* Mech. 28 Aug. 1963 p 134-152 refs (See N64-23551 16-01)

The Volterra equations, which use the principle of total interchangeability of integration and differentiation, are analyzed when subjected to solutions through the Dobronravov method. An actual application is made of the Volterra–Dobronravov equations to the formulation of the equations of one servosystem—a stabilized gyroframe. This article is the first example of a practical application of the methods of analytic dynamics of systems with nonholonomic couplings to the solution of concrete problems in the field of automation. A.W.

N64-23560 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF THE STABILITY OF STEADY-STATE MOTION OF A SERVO WITH FEEDBACK, WHICH IS BEING ACTED UPON BY A LOAD, TAKING INTO CONSIDERATION THE COMPRESSIBILITY OF THE OIL
G. N. Knyazev *In its* Mech. 28 Aug. 1963 p 153–165 refs (See N64-23551 16-01)

Investigation is made of the stability of the established motion of a loaded hydraulic motor with feedback, considering the compressibility of the oil and the deformation of the pipelines. The Lyapunov method is used in the study. A.W.

N64-23561 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CLASSIFICATION OF THE MOTION OF A HEAVY RIGID BODY CONTAINING A STATIONARY POINT
V. A. Chikin *In its* Mech. 28 Aug. 1963 p 166–178 refs (See N64-23551 16-01)

A discussion is presented of a new geometric concept—the antipole of the straight line relative to an ellipse; its significance to the field of dynamics is explained. A.W.

N64-23562 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
GEOMETRICAL PROPERTIES OF ANTI-POLE FOR THE CASE OF A HEAVY, NON-SYMMETRICAL BODY MOVING AROUND A STATIONARY POINT IN THE GRIOLI CASE
V. A. Chikin *In its* Mech. 28 Aug. 1963 p 179–188 refs (See N64-23551 16-01)

New properties of the antipole (a new geometric concept discussed in a previous paper) are presented relative to the rigidity of a body. A.W.

N64-23565 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINATION OF THE PERIOD OF VIBRATIONS OF A RESTRICTED RELEASING REGULATOR
N. K. Lobacheva *In its* Mech. 28 Aug. 1963 p 232–245 refs (See N64-23551 16-01)

Some problems of vibrations in clock-type mechanisms are examined. The properties of delta-functions are used for this purpose. Considering the regulator to be a system with self-induced vibrations, a formula is obtained that permits the determination of the period of the vibrations depending upon the parameters of the regulator. M.P.G.

N64-23604 Weapons Research Establishment (Australia)
AN ASSESSMENT OF THE PERFORMANCE OF ULTR WIDE ANGLE LENSES TYPE W.R.E. 3 MK. I AND W.R.E. I MK. 2
R. E. Little Feb. 1964 36 p
(WRE-TM-ISD-44)

Intensity functions for the ultrawide angle lenses types W.R.E. 1 Mk.2 and W. R. E. 3 Mk.1 were obtained photographically and used to calculate optical transfer functions. The performance of the two is compared. It was concluded from the tests performed that the ultrawide angle lens type W.R.E. 3 Mk.1 is a more satisfactory system than the W.R.E. 1 Mk.2. It has a greater aperture, f/6.3 compared to f/11, and a better overall performance, the improvement factor being of the order of 3:2. N.E.A.

N64-23615 New York U., N.Y.
FAST DELAYED COINCIDENCE TECHNIQUE: THE XP1020 PHOTOMULTIPLIER AND LIMITS OF RESOLVING TIMES DUE TO SCINTILLATOR CHARACTERISTICS
G. Present, A. Schwarzschild, I. Spirn, and N. Wotherspoon (Brookhaven Natl. Lab.) May 1964 21 p refs
(Sponsored by AEC and Army Dept.)

Tests of the new XP1020 photomultipliers in a delayed coincidence apparatus using plastic scintillators are described. Prompt resolution curves were measured as a function of energy loss in the scintillators and triggering levels of the fast discriminators used to process the multiplier outputs. The best resolution obtained with ~1 Mev loss in each scintillator was 2.1×10^{-10} sec (full width at half maximum). The effect of finite growth and decay times of the light output from commonly used scintillators on the ultimate resolving time is considered. It is shown that the growth time, due to finite transfer times in the scintillator, has a drastic effect upon the available time resolution and is probably the limiting factor in obtainable resolution with the new photomultipliers. Author

N64-23622* California U., Berkeley
FINITE ELEMENT SOLUTION FOR THIN SHELLS OF REVOLUTION
Z. A. Lu, J. Penzien, and E. P. Popov Washington, NASA, July. 1964 81 p refs
(Grant NsG-274-63)
(NASA-CR-37) OTS: $2.25

A stress analysis is presented of the elastic properties of arbitrary shells of revolution assuming small deformation. Solutions to the stress analysis problems were obtained by employing finite elements into which any shell of revolution may be subdivided. The basic finite element is a truncated conical shell. Detailed analysis of element flexibility, joint loads, matrix solution of the problem, and examples solved with the aid of a computer are presented. The developed procedures are quite general, can be applied to any symmetrically loaded shell of revolution, and cover possible variations in shell thickness, as well as boundary conditions. P.V.E.

N64-23624 Union Carbide Nuclear Co., Oak Ridge, Tenn.
X-RAY FLUORESCENCE TABLES: MICA-80 CRYSTAL
W. P. Amsbury, W. W. Lee, J. H. Rowan, and G. E. Walden 3 Jul. 1964 194 p refs
(Contract W-7405-ENG-26)
(Y-1470-G) OTS: $2.75

A critical compilation of standard reference tables of X-ray fluorescence lines has been published in convenient form for experimental use. This section of the report contains tables calculated for mica-80 crystal. Author

N64-23632 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINATION OF LOCAL DEFLECTIONS IN SHELLS OF AN LRE CHAMBER WITH VERY CLOSELY SPACED JOINTS
Yu. M. Nikitin and V. B. Metlin *In its* Certain Problem of Mech. 28 Aug. 1963 p 32–39 refs (See N64-23629 16-01)

In this article, a solution is presented that takes into account shear deformations associated with local deflections in shells of an LRE chamber with closely spaced joints. Theoretical results were compared with experimental data. G.D.B.

N64-23683 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
JOURNAL OF COMPUTER MATHEMATICS AND MATHEMATICAL PHYSICS Selected Articles
22 Nov. 1963 67 p refs Transl. into ENGLISH from Zh. Nychislitel'noi Mat. i Mat. Fiz. (Moscow) v. 3, no. 3, 1963 p 431-466, 574-580
(FTD-TT-63-808/1+2; AD-425500)

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2. METHOD OF POTENTIALS AND NUMERICAL SOLUTION OF THE DIRICHLET PROBLEM FOR THE LAPLACE EQUATION V. K. Vlasov and A. B. Bakushinskiy p 51-61 refs (See N64-23690 16-23)

N64-23690 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METHOD OF POTENTIALS AND NUMERICAL SOLUTION OF THE DIRECHLET PROBLEM FOR THE LAPLACE EQUATION
V. K. Vlasov and A. B. Bakushinskiy *In its* Journal of Computer Mathematics and Mathematical Physics, 22 Nov. 1963 p 51-61 refs (See N64-23688 16-23)

An approximation method for solving the integral equations found in potential theory is presented. The method is expanded and applied to the solution of the outer Dirichlet problem. Also shown is the practical application and convenience of using the method on an electronic computer. P.V.E.

N64-23855 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF ATMOSPHERIC RESISTANCE ON THE SYSTEM OF GRAVITATIONAL STABILIZATION OF AES
V. A. Sarichev *In its* Cosmic Res. 27 Apr. 1964 p 30-45 refs (See N64-23852 16-29)

This paper investigates the effect of the force of atmospheric resistance on the dynamics of the system of gravitational stabilization of AES. The orbit of the center of the mass of AES is assumed to be circular. This paper shows the equations of the rotating movement, obtains the necessary and sufficient conditions of asymptotic stability of natural oscillations, thoroughly analyzes the forced oscillations caused by rotation of the atmosphere, and develops the conditions of neutralization of the effect of the resistance forces on the oscillatory movement of the satellite-stabilizer system. It concludes with a short examination of the particular case of oscillations of one solid relative to the orbital system of coordinates in a resistance medium. Author

N64-23856 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SIMPLIFICATION OF THE SCHEME OF THE GRAVITATIONAL STABILIZATION SYSTEM OF A SATELLITE
V. A. Sarychev *In its* Cosmic Res. 27 Apr. 1964 p 46-66 refs (See N64-23852 16-29)

This paper examines the possibility of simplifying the scheme of the gravitational stabilization system of a satellite. It is demonstrated that a mobile connection of the satellite and stabilizer can be accomplished by a suspension having not only three but also two and even one degree of freedom. The asymptotic stability of the equilibrium configuration of the system for all angular variables can be preserved. Author

N64-23858 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MOTION OF A CHARGED PARTICLE IN A STATIONARY MAGNETIC FIELD IN THE APPROXIMATION OF AVERAGE DRIFT
V. D. Pletnev and G. A. Skuridin *In its* Cosmic Res. 27 Apr. 1964 p 74-95 refs (See N64-23852 16-29)

Consideration is given to the motion of a charged particle through a stationary, nonhomogeneous magnetic field in a drift approximation averaged over a period of oscillation of an object between magnetic mirrors. The derivation of corresponding equations of motion is based on the Volosov method. It is demonstrated that an approximation of the average drift corresponds to an approximation of the adiabatic invariant of longitudinal action (longitudinal invariant). The rate of deviation of this invariant in the approximation of average drift is found. Author

N64-23873 European Organization for Nuclear Research, Geneva (Switzerland)
A METHOD OF STUDYING HIGH ENERGY SECONDARY BEAMS IN A VACUUM AND IN A DIFFUSING MEDIUM [UNE METHODE D'ETUDE DES FASCEAUX SECONDAIRES DE HAUTE ENERGIE DANS LE VIDE ET EN MILIEU DIFFUSEUR]
J. Fronteau 25 Feb. 1964 215 p refs In FRENCH
(CERN-64-11)

This report deals with the fundamentals of the study and with the linear calculation of high-energy beams. The fundamentals stress the course of the beam trails and the polygons of acceptance, which generalize the ellipses of acceptance. The calculation portion of the report deals with Lagrange-Hamilton-Liouville beams and the transmission by a diffuser. Results of this study were applied to the Coulomb diffusion of incident beams, composed of stable particles. I.v.L.

N64-23878 New York U., N.Y. Div. of Electromagnetic Research
DIFFRACTION AT HIGH FREQUENCIES BY A CIRCULAR DISK
D. S. Jones Jul. 1963 96 p refs
(Contract AF 19(604)-5238)
(EM-188; AFCRL-63-348; AD-424124)

The integral equation for the pressure distribution on a circular disc in an axisymmetric sound wave is converted into a singular integral equation of the first kind. This singular integral equation has a simple kernel and can be transformed easily into an integral equation of the second kind which is especially useful at high frequencies. Although a direct iteration on this last integral equation fails, an indirect method is devised, insuring that each iterate is of lower order than the preceding at high frequencies. The form of the general term in the iteration is given, together with the first terms of its asymptotic behavior. It is relatively simple to estimate the error caused by stopping at any particular iterate. Detailed calculations are made for a plane wave striking the disc at normal incidence. Author

N64-23893 Stanford U., Calif. Thermosciences Div.
THE DYNAMICS OF THE FREE LIQUID SURFACE IN CYLINDRICAL CONTAINERS UNDER STRONG CAPILLARY AND WEAK GRAVITY CONDITIONS
H. M. Satterlee and W. C. Reynolds 1 May 1964 198 p refs
(Grant NSF-G-20090)
(LG-2)

The effect of the relative strengths of gravitational and surface tension forces, the equilibrium contact angle, the dynamic variation of the contact angle on the natural frequency, and the limit of stability of the free surface in a cylinder were determined. The frequency of the free surface in a cylinder was analyzed by assuming that the liquid is incompressible, inviscid, and that its motion is irrotational. The resulting eigenvalue problem was linearized, and solutions were obtained by a variational method. Two methods for calculating the limit of stability of the capillary surface in a cylinder are discussed, and calculations are made. Small-scale experiments of the sloshing behavior of liquids in cylinders were carried out as bench tests, as well as in a drop tower. The behavior observed can be satisfactorily explained by the theory presented. The limit of stability of the capillary surface in a cylinder was measured in a separate experiment and agrees with theoretical predictions. The findings of this study indicate that, relative to the behavior of a liquid in a cylinder when the equilibrium contact angle is 90° and there is no contact-angle hysteresis, reduction of the equilibrium contact angle reduces the natural frequency. Departure from 90° in either direction reduced the limit of stability. Dynamic variation of the contact angle about its equilibrium value markedly increases the natural frequency and can also have an important effect on the limit of stability. Author

N64-23897 Comitato Nazionale per L'Energia Nucleare, Frascati (Italy)
TWO-BODY EFFECTIVE MASS SPECTRA IN THE PRODUCTS OF THE REACTION $\gamma + p \rightarrow p n^+ + \pi^-$
R. Del Fabbro, M. De Pretis, R. Jones, G. Marini, A. Odian et al 24 Mar. 1964 12 p refs Submitted for Publication *Its* Nota Interna 235
(LNF-64/7)

Preliminary results of an experiment involving the reaction,

$$\gamma + p + p + \pi^+ + \pi^-,$$

are reported. In the experiment, the (π^+, π^-) invariant mass spectrum was measured, in the interval from 280 to 600 Mev, at a fixed proton laboratory angle of 35°. The data are interpreted as indicating a resonance of the (π^+, π^-) system at a total center-of-mass energy of 379 ±4 Mev with a full width at half maximum of 139 ±13 Mev. The direction of the two pions was also determined by letting each traverse a system of two spark chambers. The position of the spark chambers was chosen so to select with reasonably flat geometrical efficiency, total center of mass energies of the π-π system within the interval from approximately 280 to 600 Mev. The accepted production angles of the π-π system in the center of mass of the reaction ranged from 45° to 90° C. P.V.E.

N64-23923 Lincoln Lab., Mass. Inst. of Tech., Lexington
INTERPRETATION OF THE MAGNETIC AND CRYSTALLOGRAPHIC PROPERTIES OF COMPOUNDS WITH THE B31 STRUCTURE Technical Report 345
J. B. Goodenough 28 Jan. 1964 38 p refs
(Contract AF 19(628)-500)
(ESD-TDR-64-25; AD-435758)

The orthorhombic B31 structure, typified by MnP, is interpreted as a distortion of the hexagonal NiAs($B8_1$) structure due to metal-metal bonding within the hexagonal basal planes. The number of d-like electrons per cation is known from the chemical formula, provided the Fermi level lies in an energy gap between filled and empty bands of broadband states, as is generally the case where there is a large electronegativity difference between cation and anion. In stoichiometric materials, with an integral electron–cation ratio, it is possible to define operationally a critical cation–cation separation R_c such that the d-like states must be treated as collective states if $R < R_c$, may be treated as localized states if $R > R_c$. An empirical value for R_c is presented for transition-metal oxides. Since the cubic component of the ligand fields and the intra-atomic exchange give splittings that are larger than the widths of d-like bands, it is possible to construct schematic one-electron energy diagrams for various electron–cation ratios. From a knowledge of R_c, it is possible to distinguish localized from collective d-like states that are simultaneously present. Author

N64-23930* Maryland U., College Park
PLASMA SHEATH AND SCREENING AROUND A STATIONARY CHARGED SPHERE AND A RAPIDLY MOVING CHARGED BODY
Evan Harris Walker (Ph.D. Thesis) Jun. 1964 171 p refs
(Grant NsG-58-60)
(NASA-CR-56226) OTS: $12.50 ph

The potential and charge density distributions are derived for both a stationary charged sphere and a charged body moving rapidly through a plasma. The potential and charge density is calculated as a function of position about a stationary charge sphere, using both monoenergetic and Maxwellian velocity distributions for the ions and electrons of the ambient plasma. The ion and electron voltage-current probe characteristics and the equilibrium potential as a function of the radius of the body were calculated. For a rapidly moving body, a self-consistent method for solving the screening problem is developed that does not require iterative calculations. Equations for the solution of the screening of axially symmetric bodies are derived for plasmas in which the thermal motion of the ions can be neglected and for plasmas with a Maxwellian velocity distribution. The potential and density variation in the wake, the probe characteristics, and the impact and electric drag characteristic curves for various bodies were also calculated. P.V.E.

N64-23932* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
GEMINAL PROTON-PROTON COUPLING CONSTANTS IN CH_2 = N-SYSTEMS
B. L. Shapiro, S. J. Ebersole, G. J. Karabatsos, F. M. Vane, and S. L. Manatt Repr. from J. Am. Chem. Soc., v. 85 1963 p 4041–4042 refs
(Contract NAS7-100)
(NASA-CR-56464; JPL-TR-32-538) OTS: $1.10 ph

Spectra were recorded for various compounds of the type $CH_2 \equiv N - Y$, and $|J_{HH}|$ (gem) observations are reported. Significance of magnitudes of J and some solvent dependences is commented on. It is suggested that the sign of the J values is negative, and that one resonance form, $CH_2 \equiv N - Y$, is probably not very significant in oxime and hydrazone derivatives. D.E.W.

N64-23936* Geophysics Corp. of America, Bedford, Mass.
PLANETARY PHYSICS IV: AN EXPANSION METHOD FOR CALCULATING ATOMIC PROPERTIES I. THE ^2S AND $^2P^0$ STATES OF THE LITHIUM SEQUENCE
M. Cohen and A. Dalgarno Mar. 1964 32 p refs
(Contract NASw-840)
(NASA-CR-56318; GCA-TR-64-5-N) OTS: $3.60 ph

An expansion method is used to calculate the expectation values of various operators for the lowest ^2S and $^2P^0$ states of all members of the lithium sequence. The method is extended to the calculation of matrix elements connecting the two states, and the electric dipole transition integrals are

calculated. A comparison with the results of more refined calculations shows that despite its simplicity the method is capable of high accuracy. Author

N64-23956 Michigan U., Ann Arbor Electron Physics Lab.
DIGITAL COMPUTER ANALYSIS OF AXIALLY SYMMETRIC SOLID-BEAM ELECTRON GUNS
J. E. Boers Griffiss AFB, N.Y., RADC, Apr. 1964 153 p refs
(Contract AF 30(602)-2834)
(RADC-TDR-64-119; AD-601517)

Digital programs written in the IBM-7090 FORTRAN programing system are described and then employed in the analysis of several electron guns. The digital programs employ relaxation techniques while alternately computing electric fields and trajectories. One cycle through the program consists of three parts: (1) calculation of the voltages in the gun by solving Poisson's equation, in difference form, on a 7200-point matrix on which electrode potentials are laid out; (2) calculations of new current densities along the cathode and the setting up of new trajectory starting points along the cathode; and (3) calculation of trajectories and comparison of the new beam with the previous one. Author

N64-23964 Air Force Systems Command, Wright-Patterson AFB, Ohio Air Force Materials Lab.
THERMAL AND GAMMA RADIATION BEHAVIOR OF DYED NOMEX YARNS Technical Documentary Report, Mar.–Nov. 1963
Joyce C. Mc Grath Apr. 1964 23 p refs
(ML-TDR-64-77; AD-601573)

This program involved a comparative study of natural and dyed 100-denier yarns of Nomex (a high-temperature-resistant fiber formerly known as HT-1) to determine if the inclusion of color in the solution before fiber formation changes or affects the strength or temperature-resistant properties of the yarns after exposure to temperatures up to 600° F and/or gamma radiation. A variation in data was obtained between the dyed yarns and the natural color yarns; however, this is believed due to a variation in the yarns and not in the color process. The color-sealed yarns were furnished in very small experimental quantities with zero twist, whereas the natural yarns were furnished from a contract item and had producer's twist. At the higher temperatures, all the yarns had a tendency to become somewhat brittle and fray out. Elongation properties were more readily affected by high temperature and/or gamma radiation than the strength properties. All data obtained for the color sealed yarns, after exposure to high temperature and/or gamma radiation, indicates that the color sealing process has not adversely affected the strength and high-temperature-resistant characteristics of the Nomex yarns. Author

N64-23972 Technical Research Group, Inc., East Boston, Mass.
INVESTIGATION OF APPLIED PROBLEMS IN ELECTROMAGNETIC RADIATION Final Report
Alan F. Kay 2 Apr. 1964 35 p refs
(Contract AF 19(604)-8057)
(AFCRL-64-374; AD-601606)

Topics in electromagnetic theory that were covered in five scientific reports are propagation in multilayered media, improved feeds for aperture antennas, techniques for the analysis of radiation from bounded wave fronts, and efficient launching of surface waves. This document gives the abstracts and summaries of the reports plus supplementary pertinent information. Author

N64-23994* Space Technology Labs., Inc., Redondo Beach, Calif. Physical Electronics Lab.
INVESTIGATION OF HIGH-SPEED IMPACT PHENOMENA (11) Final Report
J. F. Friichtenicht 30 Nov. 1963 32 p refs
(Contract NASw-561)
(NASA-CR-56620; Rept.-8699-6006-SU-000) OTS: $3.60 p

More quantitative information on the impact light flash and impact ionization effects was obtained. The preliminary experiments on the interaction of high-speed particles with gaseous targets demonstrated the applicability of the electrostatic accelerator to meteor simulation. The EGO micrometeoroid detector was subjected to a comprehensive test program throughout its development. Author

N64-23995* Wisconsin U., Madison Theoretical Chemistry Inst.
THE REMOVAL OF ELECTRON-ELECTRON POLES FROM MANY-ELECTRON HAMILTONIANS
Joseph O. Hirschfelder 30 Jul. 1963 5 p refs
(Grant NsG-275-62(4180))
(NASA-CR-56560; WIS-TCI-25) OTS: $1.10 ph

In many-electron problems, the Hamiltonian has poles $1/r_{ij}$ that produce difficulties in the solution of the Schrodinger equation $H\psi = E\psi$. If ψ is taken to be $\Phi\chi$ where $\Phi = \prod_{i>j}(1 - 1/2r_{ij})$, it is found that χ satisfies the new Schrodinger equation $H'\chi = E\chi$ where the new Hamiltonian H' has no electron poles. Author

N64-24009* Chicago U., Ill.
DETECTION OF SCINTILLATION PHOTONS WITH PHOTODIODES
C. Y. Fan Repr. from Review of Scientific Instruments, v. 35, no. 2, Feb. 1964 p 158–163 refs
(Grant NsG-179-61)

A statistical theory on the efficiency of collection of scintillation photons from a scintillator by a photon detector was developed. If A_0 is the total surface area of the scintillator, A the surface area of the portion of the scintillator to which the detector is coupled, η the diffuse reflectivity of the material into which the scintillator is packed, K the probability that a photon impinging on A is absorbed by the photon detector, the photon collection efficiency is

$$\epsilon = KA/A_0\{1/1-\eta[1-(KA/A_0)]\}.$$

An experimental determination of the value of ϵ was made with photodiode CsI(Tl) unit, which was constructed primarily as a cosmic ray detector used in space vehicles. The CsI(Tl) crystal was packed in a case of high reflectance surface ($\eta = 94\%$) and coupled to two Au-Si surface barrier photodiodes with LTV 602 clear silicone potting compound. The experimental value is about 30%, which is in reasonable agreement with the theory. The dispersion of the signal output (full width at half-maximum) of this unit for the detection of 40 MeV α-particles is 75 kev at 495 kev. It is comparable with what is obtained with a CsI(Tl)-photomultiplier tube combination. Author

N64-24035* Ohio State U. Research Foundation, Columbus Antenna Lab.
INVESTIGATION OF THEORETICAL AND EXPERIMENTAL ANALYSIS OF THE ELECTROMAGNETIC SCATTERING AND RADIATIVE PROPERTIES OF TERRAIN, WITH EMPHASIS ON LUNAR-LIKE SURFACES Semi Annual Report, 1 Nov. 1963–30 Apr. 1964
1 May 1964 15 p refs
(Grant NsG-213-61)
(NASA-CR-56539; Rept.-1388-14) OTS: $1.10 ph

This report reviews work aimed at clarifying the relations between the electromagnetic scattering properties of a surface, in particular, the lunar surface, and its surface structure. Theoretical studies were made of the correlation properties of the scattered signal as a function of frequency separation and surface roughness for the adjacent frequency scattering experiments. A laboratory model of the two-frequency system was constructed to measure the correlation properties of the scattered signals from simple targets. A 10-kw transmitter facility operating at a frequency of 2.270 Mcs was completed and is now in operation. Author

N64-24036* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

SECOND-ORDER PERTURBATION THEORY IN ATOMIC AND MOLECULAR QUANTUM MECHANICS (APPLICATION TO THE ELECTRIC DIPOLE AND QUADRUPOLE POLARIZABILITIES AND SHIELDING FACTORS OF THE BERYLLIUM ATOM)

Hugh P. Kelly and Howard S. Taylor Mar. 1964 9 p refs Repr. from J. of Chem. Phys., v. 40, no. 6, 15 Mar. 1964 p 1478–1485

(Contract NAS7-100)

(NASA-CR-56513; JPL-TR-32-587)

A new method, previously used in calculating atomic correlation energies, is applicable to a wide variety of atomic and molecular problems. Use is made of the fact that it is possible in many problems to calculate exactly the first-order perturbation correction to uncoupled Hartree–Fock wavefunctions and also second-order energy expressions. Particular application is made to the numerical calculation of dipole and quadrupole polarizabilities and shielding factors for the beryllium atom. Author

N64-24049 Bettis Atomic Power Lab., Pittsburgh, Pa.

P-3 MULTIGROUP CALCULATIONS OF NEUTRON ATTENUATION IN METAL-HYDROGENOUS SHIELDS

K. Shure Feb. 1964 29 p refs

(Contract AT(11-1)-GEN-14)

(WAPD-TM-448) OTS: $0.75

Neutron penetration in water and in iron–water shields has been calculated using a P-3 multigroup program. The thermal neutron flux from a point fission source in water obtained from calculation and experiment agree to within 18% in the region between 15 and 140 cm, covering more than 9 decades of attenuation. The calculated neutron spectrum compares favorably in shape and magnitude with moments method results out to 120 cm of water. The observed variations of the thermal neutron flux in an iron–water shield are predicted by the P-3 program. Some of the differences between experiment and the predicted thermal flux within a thick iron region are due to the single energy group treatment in the calculations. Uncertainties in the high energy cross sections for iron are of sufficient magnitude to account for differences between calculation and experiment noted in the water region following iron. Author

N64-24058 Uppsala U. (Sweden) Quantum Chemistry Group

LINEAR STARK BROADENING BY CHARGED PARTICLES

Akiko Ohno (Ochanomizu U., Tokyo) 15 Oct. 1963 31 p refs *Its* Preprint 109

(Contract AF 61(052)-701)

A general theory of the linear Stark broadening of a spectral line by surrounding charged particles is presented. A general expression for the Lyman-α line shape in a plasma is given. The spectral line intensity is given for the entire system by a Fourier integral formula and the multiple interactions between the radiator (hydrogen) and the perturbers (ions and electrons) are taken into account. This theory enables considering the time-dependent in motions. The Doppler effect was neglected since infinite mass was assumed for the radiator. I.v.L.

N64-24069 Iowa State U., Iowa City

THREE COLOR PHOTOMETRY OF MARE CRISIUM DURING THE TOTAL ECLIPSE OF DECEMBER 30, 1963

Satoshi Matsushima and John R. Zink (Wisconsin State Coll.) [1964] 19 p refs Submitted for Publication

(SUI-64-19)

A three-color photometry of the eclipsed moon was carried out by a 12-inch reflector during the total eclipse. To examine the intensity and color distribution of refracted light in the umbral region, the observation was centered at Mare Crisium during the course of the eclipse. The decrease in brightness was nearly the same for all the three colors, which amounted to about 16 magnitudes. The colors of the uneclipsed Mare Crisium area were determined to be B-V = + 0.79 ± .077 and U-B = + 0.41 ± .088, whereas the corresponding values at the midtotality were + 0.67 ± .090 and + 0.44 ± .045, respectively. Thus, it was concluded that this particular eclipse did not show any reddening effect. Author

N64-24071 Johns Hopkins U., Baltimore, Md. Carlyle Barton Lab.

SURVEY OF THE ELECTRONIC STRUCTURE AND SPECTRAL BEHAVIOR OF THE URANYL ION

J. B. Newman Apr. 1964 98 p refs

(Contract AF 33(615)-1051)

(WR-AF-4; AD-436582)

The two main considerations of this report are to provide a coherent view of what is known about the uranyl ion, UO_2^+, and to discern, if possible, the course of a fresh attack on the problem of its structure. The assumption is made that in order to interpret the uranyl spectra, the electronic structure and behavior in the fixed nuclear framework must first be known. Ways of finding this structure are presented, leading to the conclusion that, given the chemical evidence for strong covalent uranyl bonds, a molecular orbital treatment is required. By using a core appoximation, a one-configuration trial solution is set up in terms of fixed configurations on immobile cores, and an antisymmetrized product of molecular orbital basis functions for the valence electrons. Author

N64-24082 Naval Research Lab., Washington, D.C. Chemistry Div.

CATALYTIC COMBUSTION OF NUCLEAR SUBMARINE ATMOSPHERIC CONTAMINANTS

J. G. Christian and J. E. Johnson 20 Mar. 1964 17 p refs (NRL-6040; AD-437177) OTS: $0.50

A laboratory-scale catalytic reactor, which duplicates shipboard CO/H_2 burners with respect to catalyst, bed depth, and space velocity, was used to study the catalytic oxidation of vapors and aerosols of a number of organic compounds. Most of the compounds were substantially converted to the theoretical yield of carbon dioxide by air over hot Hopcalite catalyst at approximately 300° C. Most of the hydrocarbons were easily oxidized but methane resisted oxidation, yielding only 30% of theoretical CO_2 at 400° C. As expected, oxygenated compounds were easily oxidized. When ammonia was oxidized over Hopcalite, a 70% yield of nitrous oxide was obtained. This result has been shown before but the formation of nitrous oxide

from pyridine, morpholine, and monoethanolamine is reported here for the first time. The catalytic decomposition of halogen compounds ranged from slight with Freon-12 to extensive with Freon-11 and methyl chloroform. All three Freons and methyl chloroform produced acidic gases in the furnace effluent and methyl chloroform and Freon-11 formed additional organic compounds over Hopcalite Author

N64-24115* Wisconsin U., Madison Theoretical Chemistry Inst.
DETERMINATION OF A PERTURBING POTENTIAL FROM ITS SCATTERING PHASE SHIFT AND BOUND STATES ENERGY LEVELS
Egil A. Hylleraas [1963] 31 p refs *In* Phys. Math., Oslo U. (Blindern), Inst. for Theoret. Phys., Rept., no. 19
(Grant NsG-275-62)
(NASA-CR-55406; WIS-TCI-16)

This paper presents calculations and analyses of reciprocal vector systems and binary systems of orthonormal functions. Wave equations, definitions, and notations are given. The function $Z_k(r)$ is discussed along with the inversion formula. The inversion problem, including potentials with bound states, is covered. Included are applications to elementary potentials. Comparison with other theories is made. Remarks on completeness relation proofs are presented. Both integral equations related to the problem and calculation of potentials for weak perturbations are incorporated in this report. G.D.B.

N64-24131 France Ministere de L'Air
ACOUSTICAL AND CINEMATIC APPLICATIONS OF OPTICAL AND ELECTRICAL PROPERTIES OF PARTICLES IN SUSPENSION [APPLICATIONS ACOUSTIQUES ET CINEMATIQUES DES PROPRIETES OPTIQUES ET ELECTRIQUES DE PARTICULES EN SUSPENSION]
Raymond Brun (Centre Natl. de La Rech. Sci.) Paris, Service de Documentation Sci. et Tech. de L'Armement, 1964 112 p refs *Its* Publ. Sci. et Tech., no. 405 In FRENCH

The following topics are discussed: specific fidelity in acoustics; applications to the determination of corrections of the length of bidimensional waveguides showing the discontinuities; resonance of certain chambers; reproduction of discontinuous signals; individual and statistical determination of specific electrical charges; and applications to the visualization and measurement of the average speed in subsonic and supersonic wind tunnels. Trans. by M.P.G.

N64-24146* National Bureau of Standards, Washington, D.C.
COLOR PHENOMENA ASSOCIATED WITH ENERGY TRANSFER IN AFTERGLOWS AND ATOMIC FLAMES
Arnold M. Bass and H. P. Broida Repr. from *its* J. of Res., Physics and Chemistry, v. 67A, no. 4, Jul.–Aug. 1963 p 379–388 refs
(NASA Order R-64)

Reactions involving reactive species produced in electric discharges are frequently characterized by the emission of visible light of many different colors. Some typical afterglows and atomic flames have been photographed, and the observed colors (or spectral distributions) are discussed with regard to the reactions from which they arise. Laboratory studies of this sort are helpful for the understanding of the energy transfer processes that occur in flames, in electrical discharges, and in the upper atmosphere Author

N64-24170 RAND Corp., Santa Monica, Calif.
NON-LINEAR INTERACTIONS OF ELECTROMAGNETIC FIELDS WITH MATTER
H. T. Yura May 1964 52 p refs
(Contract AF 49(638)-700; Proj. RAND)
(KM-4093-PR; AD-439435)

This study is an introduction to nonlinear interaction of the electromagnetic field with an isotropic, homogeneous medium. A quantum mechanical theory of two-photon propagation is presented, and an integral equation for the two-photon Green's function is derived. The classical nonlinear macroscopic Maxwell equations, which take into account double-photon effects, are derived, and the phenomenological parameters that appear in these equations are related to their corresponding quantum mechanical parameters. Auth

N64-24177 Polytechnic Inst. of Brooklyn, N.Y. Microwave Research Inst.
TRANSIENT SOLUTIONS FOR A CLASS OF DIFFRACTION PROBLEMS
L. B. Felsen 6 Mar. 1964 28 p refs
(Contract AF 19(628)-2357)
(PIBMRI-1209-64; AFCRL-64-173; AD-439210)

The study of the fields excited by impulsive sources in layered media was facilitated by a technique employed originally by Cagniard and Pekeris, and simplified subsequently by de Hoop. The procedure involves a reformulation of the time-harmonic solution so as to permit the explicit recovery of the transient result by inspection. In the present note, this method may be applied conveniently to the inversion of a certain Sommerfeld-type integral, which occurs frequently in diffraction theory, thereby unifying the analysis of a class of pulse diffraction problems. Illustrative examples include the transient response to a line source in the presence of a dielectric half-space, a perfectly absorbing and perfectly reflecting wedge, and a unidirectionally conducting infinite and semiinfinite screen. The latter applications illuminate the role of surface waves in the impulsive solution. In contrast to the time-harmonic case, a different behavior characterizes the surface waves excited on a unidirectionally conducting half plane by the incident field and by the edge discontinuity, respectively. Auth

N64-24191 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
ON THE DETERMINATION OF VERTICAL SETTLING OF THE BOUNDARY OF A HALF-SPACE IN THE CASE OF PLANAR DEFORMATION
N. M. Borodachev 6 Apr. 1963 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Stroit. i Arkhitek. (Novosibirek), v. 6, 1958 p 70–75
(RSIC-9; AD-408066)

An orthogonal system of coordinates (x,y,z), the y-axis of which is perpendicular to the boundary of a half-space, is used in determining the vertical settling of the boundary of a half-space in the case of planar deformation. Au

N64-24192 Pennsylvania U., Philadelphia Moore School of Electrical Engineering
STUDY AND INVESTIGATION OF POLARIZATION PROGRAMMING. VOL. II - POLARIZATION SYSTEMS ANALYSIS
R. S. Berkowitz, J. Choder, R. G. Mulholland, and P. Hall Griffiss AFB, N.Y., RADC, Apr. 1964 81 p refs Prepared under Subcontract for Am. Electron. Labs.
(Contract AF 30(602)-3105)
(RADC-TDR-64-128, Vol. II; AD-601332)

A theory of optimum reception over a dual channel system corrupted by polarized noise is presented. The theory assumes that binary data are transmitted in the form of orthogonal signals simultaneously transmitted over two orthogonally polarized channels. It is shown that if the interfering signal polarization is known exactly, its presence can result in a total degradation in signal-to-thermal-noise ratio of not more than three decibels. Also an "instantaneous" polarization control system is described. It is shown that for arbitrary but slowly varying interfering signal polarization it is possible to reduce significantly the effects of the interference by the successive processes of polarization measurement, adjustment of receiver polarization sensitivity, and control of transmitted signal polarization through use of a feedback link. Effects of system adjustment accuracy and speed are evaluated. Author

N64-24196 David Taylor Model Basin, Washington, D.C. Hydromechanics Lab.
SIMULATION OF A LONG-CRESTED GAUSSIAN SEAWAY Research and Development Report
Michael C. Davis Apr. 1964 23 p refs
(DTMB-1755; AD-600238)

This report concerns the realistic simulation of irregular long-crested seas. Random gaussian seaways, which approximated the Neumann spectral shape, were produced for model testing by use of an electrohydraulic control system for wave generation. Techniques and difficulties associated with the use of an analog computer for wavemaker control are discussed. Plans for further development and extension to directional sea simulation are presented. Author

N64-24201 Michigan U., Ann Arbor Radiation Lab.
THE ATMOSPHERIC PRESSURE WAVE GENERATED BY A NUCLEAR EXPLOSION Scientific Report No. 1
David B. Van Hulsteyn Feb. 1964 51 p refs
(Contract AF 19(628)-304)
(Rept.-5033-1-T; AFCRL-64-184; AD-601385)

The problem of describing the pressure wave that an observer located on the ground will detect at a distance of a few thousand kilometers from a low-altitude nuclear explosion is investigated. The result obtained entails the correlation of the theoretical values of the period and amplitude with those determined from microbarograph recordings. For the frequency spectrum considered, an isothermal atmospheric temperature model is sufficiently accurate and allows an analytic development of the Green's function. This Green's function makes it possible to express the frequency dependent pressure at an observer's position in terms of the pressure generated by a nuclear blast. It is convenient to treat this explosion by using a form of Huygen's principle, rather than a point source representation. This configuration permits the determination of the relationship between the energy of the explosion and the amplitude of the theoretical pressure pulse. An inverse Fourier transform is performed in order to determine the time variation of the pressure wave train. Author

N64-24218 Space Technology Labs., Inc., Redondo Beach, Calif.
STRUCTURAL RESPONSES TO DYNAMIC LOADING. PART I—STABILITY OF AXIALLY-LOADED THIN CYLINDRICAL SHELLS UNDER DYNAMIC LATERAL PRESSURES. PART II—THE DYNAMIC LOADING OF STRUCTURAL MODELS BY ELECTROSTATIC FORCES
Leslie R. Koval and J. P. O'Neill N.Y., AIAA [1964] 19 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C. 29 Jun.-2 Jul. 1964
(Contract NASw-504)
(AIAA Paper-64-485) AIAA: $0.50 members, $1.00 nonmembers

The results of a theoretical study of the stability of an axially loaded thin cylindrical shell under dynamic lateral pressures are presented and discussed. Nonlinear shallow shell theory is used to investigate the coupling between an axisymmetric ring-type mode and the asymmetric breathing mode into which the shell will initially buckle. Under certain conditions when the ring mode is dynamically excited, it may be possible to induce buckling at a dynamic critical pressure that is smaller than the static buckling pressure for shells having R/h ratios <200. In particular, the likely static buckling modes must have their natural frequencies about one-half of the ring mode frequency (the phenomenon is one of parametric resonance in which the ring mode parametrically excites the breathing mode), and the corresponding dynamic critical pressure for at least one mode must fall below the static buckling pressure of the shell. Author

N64-24221* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ORIGIN AND STRUCTURE OF ICY COMETARY NUCLEI
Bertram Donn Repr. from Icarus, v. 2, no. 5-6, Dec. 1963 p 396-402 refs
(NASA-RP-205)

The composition and structure of icy conglomerate comet nuclei formed by an accumulation process in the primordial solar nebula is examined. In addition to the constituents usually proposed, more complex and reactive molecules are expected. A significant proportion of compounds, stable only at low temperature, should occur also. The mixture of ices and meteoric matter would form an aggregate with a density of a few tenths of a gm per cm^3. An H_2O-ice nucleus is stable to radii of 10 km. For larger objects, compression begins to occur at the center, causing the structure of small comets and the outer regions of large comets to differ from that of the interior. Cometary meteor showers suggest that such differences do exist. Author

N64-24223 Los Alamos Scientific Lab., N. Mex.
PLUTONIUM REACTOR FUEL DEVELOPMENT Quarterly Status Report, Period Ending May 20, 1964
24 Jun. 1964 16 p
(Contract W-7405-ENG-36)
(LAMS-3096) OTS: $0.50

The current program status includes the following: (1) The last 74 Pu-Fe fuel capsules plus three Pu-Nb-Ce test capsules were removed from the LAMPRE core, the sodium was drained from the reactor system, and the reactor vessel and sodium system were filled with He at a pressure of 10 psig. A post mortem examination of the capsules was conducted. (2) A FORTRAN code was written for predicting the abundances of the various radioactive isotopes in the LAMPRE capsule at any specified time. (3) Shielding calculations and corrosion testing of Ta capsules were conducted. (4) A discussion of the Pu-Fe fuel and Pu-Nb-Ce containment was conducted. (5) The construction progress and modifications of the core test facility are reported. (6) Investigations concerning sodium intermediate heat exchangers are discussed. (7) Work on heat tested Pu-Sc alloys, having compositions in the range between 40 and 60 a/o Sc, has revealed the existence of an

intermediate phase. (8) Preliminary metallography and thermal analysis of some Ce-Ni alloys indicated that the compound Ce_7Ni_3 melts peritectally and forms a single eutectic with Ce. I.v.L.

N64-24225 Technical Research Group, Inc., Melville, N.Y.
ON THE EFFECTS OF A NONRIGID STRIP ON THE PROPAGATION OF SOUND
Visvaldis Mangulis Mar. 1964 25 p refs
(Contract Nonr-3208(00))
(TRG-142-TN-64-1; AD-437631)

The related problems of the radiation of sound from a line source near an infinite nonrigid strip in an infinite rigid plane baffle and of the scattering of a plane wave by the same strip are solved when the boundary condition on the strip is: pressure = (velocity normal to the strip) (constant acoustic impedance of the strip). Some numerical results are presented for a strip that is very wide as compared to a wavelength. Author

24 PHYSICS, PLASMA

Includes fusion; and magnetohydrodynamics. *For related information see*: 05 Astronomy and Astrophysics; 23 Physics, General; and 25 Physics, Solid-State.

N64-22891 Stanford Research Inst., Menlo Park, Calif.
MEASUREMENT OF THE SPECTRUM OF IONIZED AND NEUTRAL DENSITY FLUCTUATIONS IN A THERMALLY PRODUCED TURBULENT PLASMA
Harold S. Rothman, Harold Guthart, and Tetsu Morita Apr. 1964 49 p refs
(ARPA SD-103; ARPA Order 281-62)
(TR-15; AD-44125)

To develop an electromagnetic scattering model for the turbulent wake, a suitable autocorrelation function or power spectral density of the electron density inhomogeneities was chosen that best characterized the turbulent medium. To arrive at the autocorrelation function of the electron density fluctuations, it has been the practice to use the form of the autocorrelation function of the neutral density fluctuations as determined by measurements in the laboratory using schlieren techniques. This report describes the initial phase of an experimental program to study the spectral distribution of the charged and neutral particles in a weakly ionized, thermally produced, turbulent flow. An electrostatic ion probe and a microwave electron probe were used to examine the spectrum of the ions and electrons in the flow. The results indicate that the spectra of the electron and positive ion fluctuations in the turbulent plasma are identical. The measurements at a Reynolds number of 3,000 show that in the initial stage of decay, the bulk of the turbulent energy in the electron density fluctuations lies in a frequency range in which the power spectral density can be approximated by the relation $F(f) = F(0)(1 + c^2/f^2)^{-1}$ where f is the frequency. This spectrum corresponds to an exponential autocorrelation function with a longitudinal integral scale, A, equal to $c/2\pi U$, where U is the mean axial velocity. Author

N64-22898 General Electric Co., Philadelphia, Pa. Sp... Sciences Lab.
ON THE SOLVABILITY OF THE BOGOLIUBOV KINE... THEORY FOR PLASMAS
R. C. Mjolsness 30 Dec. 1963 37 p refs
(Contract NOnr-4188(00))
(TR-1; AD-431025)

The purpose of this report is to extend the results of ... vestigations of the Bogoliubov equations for a plasma ... cases of a spatially uniform multicomponent plasma with ... without an external magnetic field. The analogous solvabi... conditions are obtained, and their implications are examin... For the case without a magnetic field, the situation is qu... straightforward. The kinetic equations for the two-body fu... tions are reduced to a single equation that is, in form, nea... identical to Lenard's equation and may be treated by ... methods. The solvability condition is that the plasma not ... electrostatically unstable or marginally unstable according ... the Vlasov equations. When an external magnetic field ... present, Bogoliubov's theory is solvable if the plasma ... stable only to the longitudinal modes of the Vlasov equati... and not necessarily to the full set of modes permitted by ... dispersion relation. I...

N64-22900 Applied Physics Lab., Johns Hopkins ... Silver Spring, Md.
OPERATING POINTS AND STABILITY LIMITS OF A HI... PRESSURE DIRECT CURRENT PLASMA ARC
S. D. Raezer Mar. 1964 33 p refs
(Contract NOw-62-0604-c)
(CM-1043; AD-600845)

Procedures employed to determine the operating po... and stability limits of the APL split-ring, 10-mw plasma ... are described. General solutions are obtained, and the num... cal procedure for mapping areas of arc operation is describ... Aut...

N64-22902 Ohio State U. Research Foundation, Colum... Antenna Lab.
GRAPHICAL AIDS FOR ELEMENTARY EM WAVE-PLAS... INTERACTION CALCULATIONS
Richard Plugge 31 Mar. 1963 75 p refs
(Contract AF 33(657)-10426)
(Rept.-1565-2; AD-405858)

The macroscopic equations for small-signal EM w... propagation in an isotropic plasma medium are reduced ... approximations in various ranges of the parameters so t... they may be presented in nomographic (or alignment ch... form. Examples are given to illustrate using the nomogra... in obtaining approximations of the reflection coefficient, ... tenuation rate, complex permittivity, phase constant, and c... plex index of refraction of the plasma at microwave freq... cies. Other curves or charts available in the literature, wh... may be more accurate or comprehensive but are usually m... difficult to use than the nomographs, are also presented h... as they may be needed or useful in future numerical esti... tions. Aut...

N64-22918 Case Inst. of Tech., Cleveland, Ohio
ELECTROMAGNETIC POTENTIALS AND FIELD EXPA... SIONS FOR PLASMA RADIATION IN WAVEGUIDES Sc... tific Report No. 5
Robert E. Collin Mar. 1964 39 p refs
(Contract AF 19(628)-1699)
(AFCRL-64-279; AD-601394)

In order to calculate the radiation from plasmas placed in waveguides it is necessary to know the field produced by arbitrarily moving charged particles in a waveguide. Modal expansions for the vector and scalar potentials due to arbitrarily moving charged particles in a waveguide are derived and provide the generalization of the Lienard-Wiechart potentials to a waveguide environment. In addition, for a plasma filled waveguide a modal expansion of the electric field directly in terms of mode coupling with the charge motion is given. Expressions for the spectral distribution of the radiation are also obtained, both in general and for cyclotron radiation. Some specific results for the H_{10} mode excited in a rectangular guide by cyclotron motion are also presented. Author

N64-22943* National Aeronautics and Space Administration, Washington, D.C.

THE STRUCTURE OF THE DISTURBED ZONE IN THE NEIGHBORHOOD OF A SMALL CHARGED BODY IN PLASMA [STRUKTURA VOZMUSHCHENNOY V OKRESTNOSTI MALOGO ZARYAZHENNOGO TELA V PLAZME]

A. V. Gurevich Jun. 1964 24 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (USSR), v. 4, no. 1, 1964 p 3–16
(NASA-TT-F-9013)

The disturbances produced in plasma by a charged spherical body whose dimensions are much smaller than the Debye radius are considered. The distribution of the electric field is derived, as well as the distribution of electrons and ions for different values of the field potential on the surface of the body. Author

N64-22971 Innsbruck U. (Austria) Inst. for Theoretical Physics

APPLICATION OF VARIATIONAL METHODS FOR THE SOLUTION OF GASDYNAMIC AND MAGNETOGASDYNAMICS PROBLEMS

F. Cap and G. Müller 25 Feb. 1964 9 p refs
(Contract AF 61(052)-675)
(SR-8)

Stationary two-dimensional compressible flows past a cylinder are described mathematically. The potential equation is considered an Euler equation of a variational principle, and is derived. A similar process is carried out in the field of magnetogasdynamics, and an equation is derived as a variational principle of magnetogasdynamics. It can be solved in the MGD subsonic, transonic, and supersonic domains by the Ritz method. D.E.W.

N64-22997 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

REPORTS OF THE ACADEMY OF SCIENCE OF THE USSR (SELECTED ARTICLES)

5 Mar. 1963 19 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 144, no. 5, 1962 p 1022–1025, 1069–1072
(FTD-TT-62-1795/1+2+4; AD-299842)

CONTENTS:

1. A KINETIC DESCRIPTION OF QUASI-EQUILIBRIUM TURBULENT PROCESSES IN A PLASMA Yu. L. Klimontovich p 1–7 refs (See N64-22998 16-24)

2. THE CATALYTIC PROPERTIES OF CHELATE POLYMERS G. K. Boreskov et al p 8–16 refs (See N64-22999 16-07)

N64-22998 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A KINETIC DESCRIPTION OF QUASI-EQUILIBRIUM TURBULENT PROCESSES IN A PLASMA

Yu. L. Klimontovich *In its* Rept. of the Acad. of Sci. of the USSR 5 Mar. 1963 p 1–7 refs (See N64-22997 16-24)

A system of equations is derived that describes the change with time of the homogeneous turbulence in a plasma. The system is inadequate to express the space-time spectral functions in the nonequilibrium case. However, the system leads to more general space-time correlation functions. D.E.W.

N64-23053* National Aeronautics and Space Administration, Washington, D.C.

STUDY OF ELECTROMAGNETIC WAVES IN PLASMAS SINCE THE BOLTZMANN EQUATION [ETUDE DES ONDES ELECTROMAGNETIQUES DANS LES PLASMAS A PARTIR DE L'EQUATION DE BOLTZMANN]

Jean-Francois Denisse Jun. 1964 33 p refs Transl. into ENGLISH from the book "La Theorie des Gaz Neutres et Ionises" New York, John Wiley & Sons, 1960 p 357–374
(NASA-TT-F-9001)

Landau absorption in a plasma without magnetic field is studied, and the absorption of transverse waves is similarly examined. These effects are examined by setting up the dispersion equation for the waves on the basis of Boltzmann's equation together with Maxwell's equation. The substitution method based on the macroscopic equations and the Laplace-transform method were both used. Both give the same results and the same dispersion equations. D.E.W.

N64-23102 Avco-Everett Research Lab., Everett, Mass.

USE OF GUARD RING SHIELDS ON NEGATIVELY BIASED LANGMUIR ION COLLECTION CURRENT PROBES

G. S. Janes and J. P. Dotson Apr. 1964 6 p ref
(Contract AF 49(638)-659)
(AMP-137; AD-600473)

During investigation of an annular electrostatic plasma accelerator, floating biased double probes were used to measure ion fluxes. These probes were traversed through regions of widely varying voltage gradients, electron temperatures, and ion current densities. The ion collection probe was biased at a potential low enough to reject the highest temperature electrons encountered during a traverse. Described is a shielded ion collection probe providing a constant effective ion collection area. G.D.B.

N64-23127* National Aeronautics and Space Administration, Washington, D.C.

ON THE ADIABATIC INVARIANT MOTIONS OF A CHARGED PARTICLE IN A STATIONARY NONHOMOGENEOUS MAGNETIC FIELD [OB ADIABATICHESKIKH INVARIANTAKH DVIZHENIYA ZARYAZHENNOY CHASTITSY V STATSIONARNOM NEODNORODNOM MAGNITNOM POLE]

V. D. Pletnev and G. A. Skuridin Feb. 1964 25 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 3 Nov.–Dec. 1963 Previously published as N64-22029 15-24
(NASA-TT-F-8828)

The principles of the classical theory of adiabatic invariants are used to consider the conditions for the conservation of the first, second, and third invariant of the motion of a charged particle in a three-dimensional magnetic system. Such a motion of a particle in a magnetic field is not, strictly speaking, conditionally periodic. Therefore, in principle, the adiabatic approximation may diverge because the variables

in the Hamilton-Jacobi equation cannot be separated. A problem is formulated for evaluating the accuracy of the conservation of the second and third invariants in a stationary magnetic field. Author

N64-23207 Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France)
A DISCHARGE IN LITHIUM VAPOR [UNE DECHARGE DANS LA VAPEUR DE LITHIUM]
M. Fumelli Brussels, EURATOM, Apr. 1864 35 p refs Presented at 4th Ann. Meeting of the Am. Phys. Soc., Div. of Plasma Phys., Atlantic City, 28 Nov.–1 Dec. 1962 Available from Belgian Am. Bank and Trust Co., N.Y., Account No. 121.86: 60 Belg. Fr.
(Contract EURATOM 007-62-1 FUAF)
(EUR-1627.F)

A highly ionized steady-state lithium plasma column 50 cm long, 5 cm diameter, is obtained with a reflex discharge in a magnetic mirror geometry. The Li vapor is supplied into a hot, hollow, cylindrical anode by a controlled temperature oven. With a vapor feed of 2.5×10^{-4} g/sec magnetic field of 1,250 to 2,500 gauss, discharge current up to 5 amp, voltage 400 v, typical plasma densities near the axis of about 5×10^{12} ions/cm^3, and electronic temperatures of about 2 ev are measured by Langmuir probes. A minimum gas pressure around the column of 1.5×10^{-7} mm Hg has been achieved. Spectrometric mass analysis shows Li^+ and Li^{++} ions. Preponderance of Li^{++} can be obtained. Author

N64-23211 Princeton U., N.J. Plasma Physics Lab.
NUMERICAL COMPUTATIONS FOR ION PROBE CHARACTERISTICS IN A COLLISIONLESS PLASMA
Francis F. Chen Feb. 1964 58 p refs
(Contract AT(30-1)-1238)
(MATT-252)

Numerical results in ranges of experimental interest are presented in graphical form for the potential profile around negatively biased spherical and cylindrical probes in a collisionless plasma and for the saturation ion current–voltage characteristics. The computations were made on the basis of the theories of Allen, Boyd, and Reynolds for zero ion temperature and of Bernstein and Rabinowitz for monoenergetic ions. These theories are useful primarily for small probes. For large probes the theory of Lam is applicable, and curves for this theory are presented. Author

N64-23222 Innsbruck U. (Austria) Inst. for Theoretical Physics
INTERPRETATION OF MAGNETOGASDYNAMIC FLOW PATTERNS
Helmut Friedel and F. Cap 25 Apr. 1964 18 p refs
(Contract AF 61(052)-675)
(SR-10)

For initial magnetic fields of 0, 1,000, and 10,000 gauss, the two-dimensional steady flow of a plasma in a nozzle is constructed using the MGD characteristics method of F. Cap. The potential equation given was transformed from the flow plane into the hodograph plane by means of a Legendre transformation. G.D.B.

N64-23284 Argonne National Lab., Ill.
EFFECT OF A TRANSVERSE MAGNETIC FIELD ON VERTICAL TWO-PHASE FLOW THROUGH A RECTANGULAR CHANNEL
Richard J. Thome (M.S. Thesis–Syracuse U.) Mar. 1964 50 p refs
(Contract W-31-109-ENG-38)
(ANL-6854) OTS: $1.25

Metered streams of sodium–potassium alloy (NaK) and nitrogen were mixed and pumped through a vertical, constant-area, rectangular channel with a transverse magnetic field applied perpendicularly to the long side of the cross section. The results are as follows: (1) The magnetic field tended to make the gas distribution more uniform. There was no observable tendency for the field to shift the gas to either side of the channel in the direction of the imposed field. (2) The effect of the magnetic field was to increase slip ratio in all cases. (3) The magnetic field was observed to virtually nullify the tendency for the introduction of a gaseous phase to greatly increase pressure drop above the single phase value at the same liquid flow rate. This effect was predicted reasonably well by a magnetic two-phase, friction-factor multiplier, which was based on a simplified model. Author

N64-23336 Illinois U., Urbana Coordinated Science Lab.
LECTURES ON MAGNETOHYDRODYNAMICS
V. C. A. Ferraro Mar. 1964 90 p Lectures Presented in Semester, 1963–1964
(Contract DA-36-039-AMC-02208(e))
(R-197; AD-436274)

The history of magnetohydrodynamics, including theories of Maxwell, Larmor, Cowling, and Alfvén, is presented. Equations of magnetohydrodynamics based on Maxwell's equations of the electromagnetic field and equations of motion of the conducting field are outlined and interpreted. On the basis of selected equations, the existence and stability of magnetohydrostatic configurations, magnetohydrodynamic waves in relation to the presence or absence of a magnetic field, and hydromagnetic stability are discussed. Astrophysical applications of magnetohydrodynamics are also discussed. E.C.

N64-23431 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEUTRALIZATION OF AN ION BEAM WITH ELECTRONS IN A MAGNETIC FIELD
V. N. Danilov 17 Apr. 1964 12 p refs Transl. into ENGLISH from Tr. Fiz.-Tekhn. Inst. (USSR), no. 10, 1962 p 83-86
(FTD-TT-64-176/1+4; AD-438227)

The problem of neutralizing an infinitely flowing ion beam with electrons in the presence of a weak magnetic field is considered. It is assumed that the beam moves in an absolute vacuum and that the thermal velocities of the electrons can be ignored. Preliminary observations indicate that if there is a stationary solution to such a problem, it exists in the form of neutralizing waves of very low amplitude and short length. P.V.

N64-23479 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
JOURNAL OF APPLIED MECHANICS AND TECHNICAL PHYSICS
25 Feb. 1963 20 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 1, 1962 p 15-19, 39-43, 153
(FTD-TT-62-1695/1+2; AD-299627)

CONTENTS:

1. MAGNETOHYDRODYNAMIC PROBLEMS CONCERNING SETTLED CONVECTION IN VERTICAL CHANNELS S. A. Regirer p 1-7 refs (See N64-23480 16-3

2. ON THE INFLUENCE OF PRANDTL NUMBER VARIABILITY ON THE FLOW IN THE VICINITY OF CRITICAL POINT OF AN OBTUSE BODY AT SMALL REYNOLDS NUMBERS I. N. Murzinov p 8–15 refs (See N64-23481 16-11)

3. ON PARTIAL SOLUTIONS OF EQUATIONS OF HYDRODYNAMICS OF RAREFIED PLASMA FOR AXIALLY-SYMMETRICAL MOVEMENTS V. P. Korobeynikov p 16–17 refs (See N64-23482 16-24)

N64-23480 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MAGNETOHYDRODYNAMIC PROBLEMS CONCERNING SETTLED CONVECTION IN VERTICAL CHANNELS

S. A. Regirer *In its* Journal of Applied Mechanics and Technical Physics 25 Feb. 1963 p 1–7 refs (See N64-23479 16-24)

An analysis of the flow of an electrically conductive liquid in the presence of a magnetic field in vertical cylindrical channels is presented. P.V.E.

N64-23482 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON PARTIAL SOLUTIONS OF EQUATIONS OF HYDRODYNAMICS OF RAREFIED PLASMA FOR AXIALLY-SYMMETRICAL MOVEMETTS

V. P. Korobeynikov *In its* Journal of Applied Mechanics and Technical Physics 25 Feb. 1963 p 16–17 refs (See N64-23479 16-24)

Equations describing the nonstationary movement of a rarefied plasma, having cylindrical symmetry, are presented, and a method for finding solutions for the equations is discussed. P.V.E.

N64-23499 France. Office National d'Etudes et de Recherches Aeronautiques, Chatillon-sous-Bagneux

MEASUREMENT OF FORCES EXERCIZED BY A MAGNETIC FIELD ON A SUPERCONDUCTOR [MESURE DES FORCES EXERCEES PAR UN CHAMP MAGNETIQUE SUR UN SUPRACONDUCTEUR]

Emile Gaignebet 1964 21 p Presented at Semaine d'Etude sur les Gyroscopes Mecan., Saclay (France) 20–24 Apr. 1964 In FRENCH

(ONERA-TP-112)

The results of various measuring experiments on superconductors are presented. The results obtained are of interest to utilizers of the Meissner effect, in particular, to designers of gyroscopes for low-temperature magnetic guidance. The results of the actual measurements are in good agreement with those obtained by theory. trans. I.v.L.

N64-23605 Stanford U., Calif. Electron Devices Lab.

COMPUTER MODEL OF A BEAM-GENERATED PLASMA

D. A. Dunn and I. T. Ho Dec. 1963 50 p refs

(Contract AF 33(657)-11144)

(SEL-63-138; TR-0309-2; AD-436022)

A one-dimensional charge sheet model of an electron beam traveling through a diode and continuously creating electron and ion charge sheets within the diode is analyzed using a computer to follow the motions of the charges during the buildup time to a quasi-equilibrium condition. A step-by-step calculation of the self-consistent field of the charges of the beam and the plasma charges created by the beam is carried out in a way that holds the total number of charge sheets constant, but increases the charge per sheet as more charges are created. A plasma is created that has a density much greater than the beam; large-amplitude plasma oscillations develop with density variations of both electrons and ions about an average density that has a value roughly in agreement with the prediction of static theory. Author

N64-23681 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON PLASMA ACCELERATION BY A MAGNETIC FIELD

S. I. Fadeyev *In its* Eng. J. 23 Mar. 1964 p 39–46 refs (See N64-23676 16-01)

In the present paper, a method is proposed for the calculation of the characteristics of discharge devices used for the creation of strong shock waves by means of electromagnetic acceleration, provided that the parameters of the external circuit are given. The hydrodynamic processes in the discharge device are considered in the one-dimensional approximation. The following two assumptions are essential: (1) the entire mass of the gas behind the shock wave is situated in the shock wave itself; (2) the magnetic field H of the discharge exerts a pressure $H^2/8\pi$ on the current-carrying particles of the ideally conducting gas, concentrated in the shock wave. The problem reduces to the integration of a system of two ordinary second-order differential equations, the first of which describes the process in the oscillatory circuit (external network and discharge device) of variable inductance and resistance, whereas the second expresses the law of motion of the shock wave as a function of the intensity of the discharge current. Author

N64-23788 Joint Publications Research Service, Washington, D.C.

KINETIC EQUATIONS FOR PLASMA ELECTRONS AND THE PHOTONS RADIATED BY THEM IN A STRONG MAGNETIC FIELD

J. G. Bar'yakhtar and S. V. Peletminskiy *In its* Izv. VUZov: Radiophys. 18 May 1964 p 43–61 refs (See N64-23783 16-28) OTS: $5.00

Derived are kinetic equations for electrons and photons in plasma placed in a strong magnetic field. The absorption processes and the photon radiation are taken into account. Author

N64-23789 Joint Publications Research Service, Washington, D.C.

WAVE TRANSFORMATION ON A PLASMA BOUNDARY IN A MAGNETIC FIELD

V. M. Kontorovich and I. M. Kutik *In its* Izv. VUZov: Radiophys. 18 May 1964 p 62–77 refs Presented at the Third Conf. on Magneto-Hydrodynamics, Riga, July 1962 (See N64-23783 16-28) OTS: $5.00

The mutual transformation is considered of longitudinal and transverse waves at the plasma boundary both in a weak and, at the transverse propagation, in an arbitrary magnetic field. In a weak field the transformation coefficients have typical maxima for certain angles of incidence; the position and magnitude of the peak, as well as its width, are dependent on frequency. Author

N64-23884 Lockheed Missiles and Space Co., Sunnyvale, Calif.

RF BLACKOUT IN PLASMA SHEATH SURROUNDING A RE-ENTRY VEHICLE: AN ANNOTATED BIBLIOGRAPHY

Jack B. Goldmann, comp. Apr. 1964 47 p refs

(Contract NOw-63-0050-c)

(SB-64-10; Rept.-2-60-64-23; AD-441586)

Both theoretical and industry-proven techniques of RF transmission during reentry have been emphasized in this annotated bibliography. There are 83 references that have appeared in print between the years 1960–1963. The arrangement of entries is alphabetical according to personal or corporate author. Author and corporate source indexes are included.
Author

N64-23929* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS FROM THE IMP-I RETARDING POTENTIAL ANALYZER
G. P. Serbu May 1964 22 p refs
(NASA-TM-X-55004; X-615-64-109) OTS: $2.60 ph

Presented are some preliminary experimental results obtained with a planar geometry retarding potential analyzer that was flown on the IMP-I Satellite. The plasma energy spectrum for both ions and electrons was measured in the range from 0 to 100 electron volts. Charged particle density measurements have been obtained continuously from 1000 km to 30 earth radii. The results show a sharp decrease of about an order of magnitude in charged particle density at about 4.5 R_E, similar to the decrease deduced from whistler observations. The electrons exhibited thermal energies for geocentric distances less than 4.5 R_E. The average electron energy then increased gradually to values above 100 electron volts at about 8 R_E. the observed satellite potential was less than 1 v positive.
Author

N64-23955 Polytechnic Inst. of Brooklyn, N.Y. Microwave Research Inst.
INVESTIGATION OF AN RF PROBING TECHNIQUE FOR THE MEASUREMENT OF LOW PLASMA ELECTRON DENSITIES
Nicolas Worontzoff Griffiss AFB, N.Y., RADC, Apr. 1964 59 p refs
(Contract AF 30(602)-2149)
(PIBMRI-1165-63; RADC-TDR-64-110; AD-601533)

This report describes experiments relating to electromagnetic probing of a low-density plasma at frequencies in the range 100 to 300 mc. In particular, the limitations on a parallel-plate, capacitor probe and a "coaxial" discharge tube are described.
Author

N64-23985 Brown Engineering Co., Inc., Huntsville, Ala. Research Dept.
DETERMINATION OF ELECTRON DENSITY DISTRIBUTION IN A PLASMA JET USING A LANGMUIR PROBE
S. H. Leong Feb. 1964 21 p refs
(Contract DA-01-021-AMC-85(Z))
(R-89; AD-439007)

An elementary theory of the Langmuir probe is outlined to indicate the type of information obtainable by this technique. Difficulties arising in interpretation of data and instrumentation are discussed.
Author

N64-24078 University of Southern Calif. Engineering Center, Los Angeles
RESEARCH ON RAREFIED GASDYNAMICS AND PLASMADYNAMICS
Raymond L. Chuan Dec. 1963 80 p refs
(Grant AF-AFOSR-55-63)
(USCEC-93-101; AFOSR-64-0565; AD-436451)

A study is made of the dynamics of high-speed low-density flows of neutral and partially ionized gases. The low-density wake problem was pursued intensively, both theoretica from the free molecule viewpoint and experimentally o a wide range of Knudsen numbers for two-dimensional ca of the circular cylinder and the flat ribbon. Also, the exp mental phase of the free molecule electrostatic probe w pursued, yielding results that generally supported the the
J.R

N64-24105* National Aeronautics and Space Administrati Lewis Research Center, Cleveland, Ohio.
MONTE CARLO SOLUTION FOR THE CHARACTERISTI OF A HIGHLY RAREFIED IONIZED GAS FLOWI THROUGH A CHANNEL WITH A TRANSVERSE MAGNE FIELD
Morris Perlmutter [1964] 28 p refs Presented at the Intern. Symp. on Rarefied Gas Dyn., Toronto, 7–14 Jul. 19
(NASA-TM-X-52033) OTS: $2.60 ph

The steady flow of a highly rarefied ionized gas throug channel with a magnetic field normal to the channel wall studied. The solution is obtained by a Monte Carlo proced This method consists of following sample ions through channel. By tallying properties of these ions as they p scoring cross sections of the channel, the various local pr erties of the flows such as density, mass flows, energies, wall shear stress are obtained. These results for the sm magnetic field cases were compared with the limiting analyt solutions for no magnetic field and were in good agreem with them.
Aut

N64-24172 Stanford U., Calif. Microwave Lab.
MICROWAVE AND ELECTRON BEAM INTERACTIO WITH A FINITE PLASMA
H. L. Stover Griffiss AFB, N.Y., RADC, Apr. 1964 251 p
(Contract AF 30(602)-2575)
(RADC-TDR-64-117; AD-601363)

This study investigates, both theoretically and experim ally, the interaction between an electron beam and fi plasma system. In the formal theoretical analysis, the plas and beam are treated as frequency-dependent dielectrics. propagation and field theory is developed for the slow wa of a plasma column that has a radial variation in electr density and is in a d.c. magnetic field, and a gain theory developed for a zero-temperature finite beam-plasma syst in a finite d.c. magnetic field. Also, the attenuation of t slow waves on a plasma column is investigated both theoret ally and experimentally.
J.R

N64-24203 Florida State U., Tallahassee
INTERACTION OF MICROWAVES IN A PLASMA Progr Report Jan. 23, 1962–Jan. 23, 1964
Edward A. Desloge [1964] 148 p refs
(Grant DA-ARO(D)-31-124-G234; DASA-WEB-07.010)
(AROD-3420-8; AD-441223)

CONTENTS:
1. INTERACTION OF ELECTROMAGNETIC WAVES A PLASMA S. C. Bloch and E. A. Desloge 6 p refs
2. EXCHANGE OF ENERGY BETWEEN TWO GAS AT DIFFERENT TEMPERATURES E. A. Desloge p 122 1225
3. CONDUCTIVITY OF AN IONIZED GAS E. A. Desl p 1–39 refs
4. FOKKER-PLANCK EQUATION E. A. Desl p 237–246

5. COEFFICIENTS OF DIFFUSION, VISCOSITY, AND THERMAL CONDUCTIVITY OF A GAS E. A. Desloge p 911–920

6. TRANSPORT PROPERTIES OF A SIMPLE GAS E. A. Desloge p 1–44 refs

7. TRANSPORT PROPERTIES OF A GAS MIXTURE E. A. Desloge p 1–27 refs

25 PHYSICS, SOLID-STATE

Includes semiconductor theory; and masers. *For related information see*: 09 Electronics; 23 Physics, General; and 24 Physics, Plasma.

N64-22897 Stanford U., Calif. Microwave Lab.
THE THEORY OF DIRECT TRANSITIONS IN SEMICONDUCTORS
R. H. Pantell, M. Di Domenico, Jr. (Bell Telephone Labs., Inc.), and O. Svelto (Inst. di Fis. Del Politec.) 1964 23 p refs (Contract Nonr-225(48))
(ML-1131; AD-431112)

The problem of direct interband transitions in semiconducting crystals is considered in detail. The solution of the problem led to a system of simultaneous coupled nonlinear differential equations. These equations do not distinguish between static and dynamic fields, and are obtained without recourse to any approximation procedures. They therefore apply for electromagnetic fields of arbitrary amplitude. The linearization of these equations correctly predicts the fundamental optical absorption edge and the photoconductive rate equations resulting in photomixing phenomena. Author

N64-22908 Carnegie Inst. of Tech., Pittsburgh, Pa. Metals Research Lab.
THE EQUILIBRIUM AND KINETIC MORPHOLOGY AND STRUCTURE OF SOLID SURFACES Final Report, 1 Feb. 1961–31 Jan. 1964
W. W. Mullins 21 May 1964 5 p refs
(Contract DA-ORD-31-124-61-G11)
(AROD-2781-8; AD-600729)

The current program status includes the following: (1) Analytic investigations were completed on the healing of annealed scratches in solid surfaces under the assumption that isotropic surface parameters, and surface and volume diffusion contribute to material transport. (2) A description of the motion of a train of monatomic ledges sweeping across a crystal during evaporation or condensation by a system of ordinary differential equations permitted a delineation of the conditions under which bunching would occur and would propagate through the train. (3) A theoretical study was made of the surface free energy of a crystal as a function of crystallographic orientation, taking into account, for the first time, the entropy contribution arising from the random configuration of a given ledge on the strip of a surface defined by the two adjacent ledges. I.v.L.

N64-23002 Joint Publications Research Service, Washington, D.C.
INFRA-RED EXCITATION OF FLUORESCENT CRYSTAL $CaF_2:Dy^{2+}$
Liu Sung-Hao, Wu Hsin-Neng, Lin K'ai-Hua, Ts'ui Feng-Kuei, Ch'en Shu-Ch'un et al *In its* Transl. on Communist China's Sci. and Technol., no. 362 25 May 1964 p 1–4 refs (See N64-23001 16-01) OTS: $0.75

The preparation of $CaF_2:Dy^{2+}$ crystals, the determination of their fluorescence spectra, and the results of infrared excitation of these crystals at liquid-nitrogen temperature are reported. The fluorescence spectra, measured at 77° K, showed a strong discrete band at 2.39μ as well as several weaker bands. The 2.39μ band was found to be temperature dependent, disappearing at 250° K. This emission band is just within the range of atmospheric irradiation at which the atmospheric absorption and scattering become negligible. Oscillograph records of the infrared irradiated emission indicate an excitation energy of 71 juoules and a relaxation oscillation time of 1.5 milliseconds. This value is related to the long lifetime of the 5/7 energy level producing the fluorescence. Such a prolonged lifetime is advantageous in the operation of continuous excitation light-source action. M.P.G.

N64-23003 Joint Publications Research Service, Washington, D.C.
THE INFRA-RED EXCITATION OF FLUORESCENT CRYSTAL $CaF_2:U^{3+}$
Cho Hsin-Neng, Liu Sung-Hao, Lin K'ai-Hua, Ts'ui Feng-Kuei, Wang Fu-Kuei et al *In its* Transl. on Communist China's Sci. and Technol., no. 862 25 May 1964 p 5–7 refs (See N64-23001 16-01) OTS: $0.75

The preparation of a $CaF_2:U^{3+}$ (0.06-mole-percent uranium) single crystal and the determination of its infrared excitation emission are reported. Oscillograph records are presented that were obtained at energy inputs of (a)386 Joules and (b) 291 Joules when the sample was excited by a pulsed xenon discharge lamp. The oscillation of (a) was greater than that of (b), and oscillation of (a) started earlier and lasted longer than that of (b). The fluorescent lifetime of 140± 20μsec and the fluorescence absorption maximum observed at 2.61μ are identical with results reported by others. M.P.G.

N64-23004 Joint Publications Research Service, Washington, D.C.
EXPERIMENTAL SPLITTING OF R FLUORESCENCE SPECTROSCOPIC GROUND STATES IN ORIENTAL RUBY
Lu Tay-Yuan, Yu Wen-Yen, T'ang Kuei-Chen, and Chang Chi-Jen *In its* Transl. on Communist China's Sci. and Technol., 25 May 1964 p 8–13 refs (See N64-23001 16-01) OTS: $0.75

The Cr^{3+} in oriental ruby, acted upon by a crystalline triangular field and orbital spin, has zero-field splitting for the ground states ($^4A_2$) of its R lines. Using a Fabry–Perot interferometer, the determination was made by observing the R-line fluorescence that the ground-state splitting value is 0.38 cm^{-1}. This value is in accord with theoretical calculations and experimental results by other methods. The high intensity ratio of the two values of the R_2 line was also determined, and the following conclusions are drawn: (1) Under ordinary exposure, R_2 has only a long-wave portion because the only transition probability of R 1/2 is toward $\pm$ 1/2($^4A_2$), whereas the only transition probability of R_2 is toward $\pm$3/2($^4A_2$); (2) under fluorescence, the transition probability of R1/2 is much larger than that of R_2; and (3) under fluorescence at low temperatures, the intensity of R_2 lines cannot have any R_2 (short-wave) portion. No explanation is given for these differences in the transition probability and the absorption transition probability of the R fluorescence. M.P.G.

N64-23141 Brown U., Providence, R.I. Div. of Applied Mathmatics

FREQUENCY RESPONSE OF NON-LINEAR VISCOELASTIC SOLIDS

F. J. Lockett and M. E. Gurtin Mar. 1964 17 p refs
(Contracts Nonr-562(10); Nonr-562(30))
(AD-434682)

This report considers a nonlinear viscoelastic solid with a one-dimensional constitutive equation. The problem is discussed in terms of the complex moduli, oscillatory strain history, single-frequency applied strain, high-order moduli, high-order theories, constitutive equation in the transform domain, and forced vibrations of a mass on a nonlinear viscoelastic bar. G.D.B.

N64-23167 Westinghouse Electric Corp., Youngwood, Pa. Semiconductor Div.

THERMOELECTRIC TEMPERATURE CONTROL FOR QUARTZ CRYSTALS AND CRYSTAL OSCILLATORS Second Quarterly Progress Report, 1 Aug.–31 Oct. 1963

Thomas D. Merritts [1963] 32 p
(Contract DA-36-039-AMC-02194(E))
(Rept.-6; AD-433627)

Experimental investigations on the heat pumping performance and stabilization time are presented for a 24-couple hybrid module consisting of 1/8 in. × 1/8 in. × 1 in. size pellets. It is shown that for thermoelectric chamber designs it is most advantageous to use modules having 1/16 in. × 1/16 in. × 1/4 in. size pellets. In establishing simple and efficient control circuits, experimental investigations on several d.c. to d.c. power converter designs using medium power germanium transistors are given. Author

N64-23176 Marquardt Corp., Van Nuys Calif.

SOLID STATE BONDING

M. J. Bloom [1964] 46 p refs Presented at the Design Eng. Conf. Symp., Am. Soc. of Mech. Engr., Chicago, 11–14 May 1964

Solid-state bonding is a joining technique in which time, temperature, and pressure produces, through diffusion, coalescence of the base materials being bonded. There was a growing interest in this joining procedure particularly for the reactive and refractory metals. To properly incorporate this technique into current and advanced designs, it is necessary to understand the bonding process thoroughly. To achieve this understanding, practical information such as material preparation, joint design, fixturing, etc. is presented along with a discussion of the principles and mechanisms for solid-state bonding. Specific examples of solid-state bonds in a number of materials are offered as evidence of the feasibility of this technique for difficult-to-join metals. Finally, the advantages of using this process in lieu of conventional joining methods and its applicability in several different fields are discussed.

Author

N64-23475 Texas Instruments, Inc., Dallas Apparatus Div.

SOLID-STATE TECHNIQUES FOR MODULATION AND DEMODULATION OF OPTICAL WAVES Second Quarterly Progress Report, 1 Oct.–30 Dec. 1963

D. D. Eden et al [1963] 29 p refs
(Contract DA-36-039-AMC-03250(E))
(U2-802400-2; AD-600419)

A detailed investigation of certain cubic electro-optic materials is presently underway. Studies on cuprous chloride and hexamethylene-tetramine were initiated. These materials have Pockel's coefficients with magnitudes comparable to KDP and further may be operated with the applied electric field oriented transverse to the light path. Since their microwave dielectric permitivities and loss tangents are appreciably smaller than in KDP, and since their high symmetry indicates a wide angular field of view, their performance potential would appear to be higher than in KDP. A large signal gain effect at avalanche breakdown voltage was observed in both planar and mesa silicon photodiodes. A signal-to-noise ratio improvement of as high as 13 db was measured at microwave frequencies in the L-band region. This effect is similar to the multiplier photo tube gain effect in that a signal amplification in the avalanche region results by collision induced electron multiplication. Near the avalanche breakdown voltage increases in signal strength were observed as high as 28 db. The general signal enhancement effect at avalanche breakdown was observed for modulation frequencies ranging all the way from the audio to the microwave range. The highest microwave modulated frequency seen with silicon photodiodes was with using the avalanche effect; this was at a frequency in excess of 2 kmc. Author

N64-23807 Joint Publications Research Service, Washington, D.C.

SIMPLE THERMOSTAT FOR MASER RESONATOR

G. M. Strakhovskiy and V. M. Tatarenkov *In its* Izv. VUZov: Radiophys. 18 May 1964 p 285–288 ref (See N64-23783 16-28) OTS: $5.00

A simple thermostat was tested to maintain the resonator temperature constant with such accuracy that no noticeable magnetic field is produced in the resonator; such a field can cause the generator frequency to change. Characteristics of the thermostat–generator are given; it was used in an ammonia maser as a thermostat for the resonators. G.D.B.

N64-23808 Joint Publications Research Service, Washington, D.C.

MASER WITH TWO TYPES OF NATURAL OSCILLATIONS OF THE RESONATOR

V. A. Shcheglov *In its* Izv. VUZov: Radiophys. 18 May 1964 p 289–296 refs (See N64-23783 16-28) OTS: $5.00

The general equations for a maser operating with one type of natural resonator oscillations were obtained from previous works, but more general equations for the material and medium were derived in this article. G.D.B.

N64-23809 Joint Publications Research Service, Washington, D.C.

MOLECULAR GENERATOR WITH TWO SERIES CAVITIES USING AMMONIA $N^{14}H_3$(3, 2 LINE)

G. M. Strakhovskiy, V. M. Tatarenkov, and O. A. Tumanov *In its* Izv. VUZov: Radiophys. 18 May 1964 p 297–299 refs (See N64-23783 16-28) OTS: $5.00

A molecular generator with two-series cavities using a beam of $n^{14}H_3$ molecules was investigated in detail. One of the main properties of such a system is the fact that the oscillation frequency in the second resonator is monochromatic and is determined with great accuracy by the oscillation frequency in the first cavity, with which it coincides. This fact can be used to produce a molecular generator with high relative frequency stability. G.D.B.

N64-23926 Naval Ordnance Test Station, White Oak, Md.
HAIR-TRIGGER OPERATION OF A NEODYMIUM LASER
David L. Caskey May 1964 82 p refs Based on M.S. Thesis —MIT
(NOLTR-64-32; AD-436893)

A laser system has been devised that provides a preselected number of laser bursts at controlled intervals by shaping the output of the optical pump light in a suitable manner. Two techniques were used. A system was constructed to demonstrate the principle. The working model provides up to three 15 μsec laser bursts per firing, while the time between bursts is controlled by preselected delays of from 50 μsec to 500 μsec. The peak power output is several kilowatts. Although the model employs a 2-in. × 1/4-in. Neodymium-doped glass laser, the method is applicable to a wide variety of laser materials and sizes. Author

N64-23959 Air Force Systems Command, Griffiss AFB, N.Y. Rome Air Development Center
IN-CAVITY LASER MODULATION STUDY
Anthony D. Rugari May 1964 25 p refs
(RADC-TDR-64-129; AD-601660)

A theoretical and experimental study was performed to investigate a laser modulation technique capable of providing a flat frequency response over the range of 30 cps to 30 mc/s with a modulation index of 0.5 or greater. The technique involved the introduction of controllable losses to the laser cavity by alternate alignment and misalignment of the cavity reflectors. This was to be accomplished by insertion of an electro-optic prism in the cavity and varying the angle of deviation of the exit beam from the prism by electrically controlling the magnitude of the index of refraction of the prism. The transmission losses associated with the electro-optic prism were experimentally found to be greater than the gain of the laser cavity. Thus, oscillations could not be maintained with the electro-optic prism in the cavity. The major factors contributing to the transmission losses were found to be reflection losses and an inherent birefringence of the crystalline materials. Pertinent theoretical discussions and experimental results are included in the report. Author

N64-23976 Ohio State U. Research Foundation, Columbus Antenna Lab.
SPATIAL COHERENCE AND POWER DENSITY OF THE COOLED RUBY LASER
N. R. Kilcoyne 31 Mar. 1964 18 p refs
(Contract AF 33(657)-10824)
(Rept.-1579-10; AD-441642)

The partially coherent light from a ruby laser is radiated in a beam with a divergence angle greater than the diffraction-limited angle of a perfectly coherent source. The divergence angle is related to the spatial coherence of the radiation field and limits the energy density of the beam. The effects of crystal temperature and pumping energy on output energy density are discussed. For the particular laser configuration measured, output energy density increases with increasing pump energy and decreases as the crystal temperature is lowered. Author

N64-24061 Oklahoma U. Research Inst., Norman
THE EFFECT OF DISLOCATIONS AND ORIENTATION UPON THE ELECTRICAL DOUBLE LAYER CAPACITY OF SILVER SURFACES, PART I. SUPPLEMENT TO FINAL REPORT OF MARCH 1, 1963: THE EFFECT OF SURFACE PREPARATION AND DISLOCATIONS ON THE SILVER CATALYZED DECOMPOSITION OF FORMIC ACID, PART II Final Report
R. G. Rein, C. M. Sliepcevich, and R. D. Daniels 1 Apr. 1964 54 p refs
(Contract Nonr-982-(08))
(AD-434716)

The double-layer capacity of silver electrodes was used to obtain a relative area that is sensitive to irregularities on an atomic scale. Care was taken to insure that clean, oxide-free surfaces were used during measurements. Areas of {110}, {111}, and {211} planes with dislocation densities ranging from 10^6 to 10^8 cm^{-2} were investigated. Although it was found that the areas of {110} and {211} planes were proportional to the log of dislocation density, the area of {111} planes was found to be independent of dislocation density. This behavior, combined with the large number of adsorbed atoms of hydrogen associated with each dislocation, 10^7, points to the conclusion that dislocations are not the primary reason for the observed changes in double-layer capacity or adsorption. Author

N64-24090 Lowell Technological Inst. Research Foundation, Mass.
EFFECTS OF EXTERNAL FORCES ON VIBRATING CRYSTAL PLATES Third Quarterly Report, 1 Nov. 1963–31 Jan. 1964
Charles R. Mingins, Robert W. Perry, and Luther C. Barcus [1964] 35 p refs
(Contract DA-36-039-AMC-02239(E))
(Rept.-11; AD-437358)

Research continued on the reaction of vibrating piezoids to externally applied forces and torques, with emphasis on rectangular plates. Special attention was given to tensile stresses because of the complications introduced by the bending of thin plates under lengthwise compression. The problems raised by the unintentional flexing of plates while being compressed led to a series of experiments in which the bending of rectangular crystals is studied. These experiments are covering flexures set up by central depression, by free cantilever action, and by clamped cantilever action. Author

N64-24103* Varian Associates, Beverly, Mass.
MEASUREMENTS AND IMPROVEMENTS OF TWO HYDROGEN MASERS Quarterly Progress Report, Dec. 1, 1963–Feb. 29 1964
R. Vessot 15 May 1964 7 p ref
(Contract NAS8-2604)
(NASA-CR-56549) OTS: $1.10 ph

This report is concerned with modifying two atomic masers, studying a solid dielectric spherical cavity, and establishing a system to make short-term measurements. According to the theory of the hydrogen maser, the amplitude fluctuations are suppressed and approach zero with increasing radiating power. It should be possible to measure the receiver noise contributions alone when the signals are in phase and to measure the contribution of the phase fluctuations when the signals are in quadrature. J.R.C.

N64-24108* Varian Associates, Beverly, Mass.
MEASUREMENTS AND IMPROVEMENTS OF TWO HYDROGEN MASERS Quarterly Progress Report, 1 Sep.–30 Nov. 1963
R. Vessot 15 Jan. 1964 14 p refs
(Contract NAS8-2604)
(NASA-CR-56550) OTS: $1.60 ph

Described is a measurement program for long- and short-term stability, using three hydrogen masers. Measurements to

determine the precision to which a given pair of masers can be reset with respect to frequency are discussed. The status of improvements to the masers is given. G.D.B.

N64-24133 Cutler-Hammer, Inc., Deer Park, N.Y. Airborne Instruments Lab.
INTERFERENCE ANALYSIS OF NEW COMPONENTS AND CIRCUITS Final Report
O. Hinckelmann, G. Kanischak, D. Kaye, A. Kiis, and C. Nieves
Griffiss AFB, N.Y., RADC, May 1964 252 p refs
(Contract AF 30(602)-2919)
(Rept.-2719-1; RADC-TDR-64-161; AD-601850)

This report is the result of an investigation to determine a satisfactory parameter to describe the interference susceptibility of solid-state components, to determine suitable solid-state components to be used as protective devices to reduce RFI susceptibility, and to determine the RFI and operational characteristics of signal-processing techniques to permit the best choice, in a given interference environment, consistent with satisfactory operational characteristics. The third-order intermodulation coefficient is the most suitable measure of RFI performance. A simple technique for measuring the parameter, as well as experimental results, are described. Three types of limiters are discussed, and it is shown that the ferrite limiter generally has the characteristics most desirable in a device for RFI susceptibility reduction. Passive frequency filtering is also considered. The signal processing techniques studied are tuned radiofrequency, High-IF (HI-IF), superheterodyne, and compressive receivers. The advantages and disadvantages of each are considered from the RFI and operational points of view. The conclusions are illustrated with examples that demonstrate the manner in which a choice can be made to achieve good RFI rejection consistent with satisfactory operational performance. Author

N64-24200 Manlabs., Inc., Cambridge, Mass.
X-RAY STUDIES OF SAPPHIRE CRYSTAL PERFECTION Scientific Report, No. 1, 1 Sep.–30 Nov. 1963
Harold Bernstein and Christina Jansen 21 May 1964 39 p refs
(Contract AF 19(628)-2466)
(AFCRL-64-423; AD-601336)

The imperfection structure of Al_2O_3 single crystals has been studied with the double-crystal X-ray spectrometer. Preliminary rocking curve measurements on the basal planes of several sapphire and ruby crystals indicated a dependence f peak multiplicity on rocking axis orientation. The results could be be interpreted in terms of an ordered stacking of line dislocations having the $<11\bar{2}0>$ Burgers vector. A pair of fully oriented 0° and 90° Verneuil crystals were examined by light microscopy, Laue back reflection photography, and diffraction techniques, revealing major differences in imperfection structure between the two crystals. Detailed rocking curve surveys of the principal planes of the 90° crystal were made, and dislocation densities were calculated from the measured half breadths in terms of proposed dislocation models. Good agreement is found between the calculated dislocation densities and those determined by each pit counting. Author

N64-24224 Stanford U., Calif. Microwave Lab.
MICROWAVE RESEARCH Quarterly Status Report, No. 20, 1 Nov. 1963–31 Jan. 1964
Apr. 1964 24 p refs
(Contract Nonr-225(48))
(ML-1148; AD-435974)

The status of the following areas is presented: (1) acoustic wave amplification; (2) optical masers; (3) ferrite nonlinear propagation; (4) diffraction of light waves by hypersound; (5) forces on neutral particles in light beams; and (6) microwave phonon transmission in single-crystal TiO_2 (rutile) at S-band. I.v.L.

26 PROPELLANTS AND COMBUSTION

Includes fuels; igniters; and oxidizers. *For related information see*: 07 Chemistry; and 27 Propulsion.

N64-22946 Hanford Atomic Products Operation, Richland, Wash. Engineering Development Operation Reactor and Fuels Lab.
COMPARISON OF BOILING BURNOUT DATA FOR 19-ROD BUNDLE FUEL ELEMENTS SPACED WITH "WIRES" AND "WARTS"
J. M. Batch and G. M. Hesson 15 Jan. 1964 17 p refs
(Contract AT(45-1)-1350)
(HW-80391, Rev. 1) OTS: $0.50

Boiling burnout heat fluxes were determined for an electrically heated model of 19-rod bundle fuel elements using warts to maintain the 0.050-in. spacing between rods. The test section was 19 1/2-in. long, and the spacers were located 6 1/4-in. from each end of the test section. The experiments were made at a pressure of 1,200 psig and at mass velocities of 500,000 to 5,000,000 lb/hr-ft^2. Exit conditions ranged from enthalpies of 350 to 700 Btu/lb. Boiling burnout heat fluxes ranged from 270,000 to 1,600,000 Btu/hr-ft^2. The test data showed almost no difference between the boiling burnout heat fluxes of test sections using wire wraps or those using warts for rod spacing. N.E.A.

N64-22966 Naval Radiological Defense Lab., San Francisco, Calif.
MEASUREMENT OF THE TEMPERATURE OF THE THERMALLY IRRADIATED SURFACE OF ALPHA CELLULOSE
N. J. Alvares 24 Mar. 1964 30 p refs
(DASA-1467; USNRDL-TR-735; AD-600768)

The transient temperature histories of exposed surfaces of specimens of alpha cellulose, irradiated by a carbon arc image furnace are radiatively measured with a liquid-nitrogen-cooled, lead sulfide detector, behind a 3.4μ, narrow band-pass interference filter. The output of the detector is displayed on an oscilloscope and is photographed. The overall time response of this system is 30 msec. Reflected arc radiation off the surface of the sample at 3.4μ is eliminated by inserting a Plexiglas filter between the arc and the specimen. A mirror is used to focus the detector onto an area of 0.21 sq cm on the surface of the specimen. The detector is calibrated by substituting a standard blackbody at the position normally occupied by the specimen during the measurement period. For irradiances of approximately 7 and 14 cal cm^{-2}sec^{-1}, the temperature of the surface at the instant of ignition was measured to be 600° C for samples thicker than 0.02 in. However, due to the possibility of small errors in the emittance and to a small but finite radiating depth over which a temperature gradient exists, the surface temperature may be somewhat greater than 600° C but not over 650° C. Author

N64-23112 Bureau of Mines, Pittsburgh, Pa. Explosives Research Center
SENSITIVITY CHARACTERISTICS OF LIQUID EXPLOSIVE SYSTEMS
Frank C. Gibson, Charles M. Mason, John Ribovich, and J. Edmund Hay Apr. 1964 11 p ref
(Contract IPR-19-64-8026-WEPS)
(PR-9; AD-438019)

Emphasis was placed on developing experimental techniques for determining the relative hazards of nitroglycerin-ethyleneglycol dinitrate (NG–EGDN), 50–50 by weight, and similar highly sensitive materials. Gap values were determined that define the threshold between initiation of low-velocity reactions and noninitiation for several materials. Trimethylolethane trinitrate (TMETN) was observed to be less sensitive to shock initiation than NG–EGDN, and about equivalent in sensitivity to NG–EGDN admixed with approximately 20% triacetin (TA). Author

N64-23148* IIT Research Inst., Chicago, Ill.
AN ANALYTICAL STUDY OF THE PROPAGATION OF PRESSURE WAVES IN LIQUID HYDROGEN-VAPOR MIXTURES Final Report
J. M. Clinch and H. B. Karplus May 1964 160 p refs
(Contract NAS3-2569)
(NASA-CR-54015; IITRI-N6054-6) OTS: $11.50 ph

The complex sound propagation constant is calculated for liquid–vapor mixtures. Sound velocity and attenuation, related to the real and imaginary components of this constant, are physically measurable quantities, governed by the state and structure of the mixture. Low frequency behavior is a function of the mixture quality or relative masses of the phases. At intermediate frequencies the propagation depends on the sound frequency and also on the size distribution of the discontinuous phase. At high frequency the propagation is essentially a function of the dominant phase. Early hopes of using low frequencies to determine the quality in two-phase flow directly are circumscribed by effects, such as noise, pipe wall heat transfer, standing waves, etc., setting limits to the lowest frequency that may be used. At intermediate frequencies the effects of size distribution and quality are difficult to separate. The high-frequency velocity is likely to be useful in determining the flow velocity of one of the phases so that other parameters of interest in two-phase flow may be deduced. Author

N64-23160 Aerojet-General Corp., Sacramento, Calif.
SOLID PROPELLANT DYNAMIC PROPERTIES AND THEIR EFFECT ON VIBRATION RESPONSE OF MODEL SOLID PROPELLANT STRUCTURES
G. J. Kostyrko *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 171–178 refs Paper Not Presented at Symp. (See N64-23151 16-01)
(Contract AF 33(600)-36610)

Three types of vibration tests have been improved and applied to the laboratory measurement of the dynamic mechanical properties of solid rocket propellants over the range 0.1 to 300 cps. These include a free-vibration reed test, a free-vibration torsion test, and a forced-vibration disc test. Computer techniques, based on linear viscoelastic theory, have been devised or improved to yield complex elastic moduli and loss tangents. Both temperature and frequency influence the dynamic properties. The Williams–Landel–Ferry time–temperature superposition principle is applicable. The relationship between reduced resonant frequency and temperature is proposed as a fundamental and useful property of a material. This relationship, measured on laboratory specimens, appears to be applicable to the prediction of the effect of temperature changes on the dynamic response of missiles. Author

N64-23233* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
CRYOGENIC SOLUTIONS AND SOLUBILITIES IN LIQUID FLUORINE
Robert E. Seaver Washington, NASA, Jun. 1964 16 p refs
(NASA-TN-D-2286) OTS: $0.50

The solubilities of several substances in liquid fluorine were determined between 68° and 83° K by vapor-pressure measurements. These experimental data, as well as a summary of literature data on solutions of solids in cryogenic liquids, are presented and compared with solubilities calculated by assuming regular solutions. Experimental and calculated values for the solubilities of carbon tetrafluoride, perfluoroethane, and perchloryl fluoride in liquid fluorine show close agreement, while the solubilities of krypton and xenon in fluorine show considerable deviation from calculated values. Little of the literature data agrees with the calculated solubilities. Deviations from calculated values are discussed. Author

N64-23249 Bureau of Mines, Bartlesville, Okla.
PERFLUOROCYCLOBUTANE: THE THERMODYNAMIC PROPERTIES OF THE REAL GAS
R. H. Harrison and D. R. Douslin [1964] 18 p refs Work Done in Cooperation with AF
(RI-6475)

The thermodynamic properties $H-H^\circ$, $(H-H^\circ)/T$, $S-S_{ideal}$, $S-S^\circ$, $F-F_{ideal}$, $F-F^\circ$, $(F-F^\circ)/T$, and activity coefficient γ for perfluorocyclobutane were calculated as functions of temperatures (115.22° to 350° C) and molal density (0.75 to 6.5 moles/liter). Improved analytical and graphical correlating techniques are described. Author

N64-23264 General Electric Co., Cincinnati, Ohio
HIGH-TEMPERATURE MATERIALS PROGRAM Progress Report No. 36, Part A
19 Jun. 1964 37 p refs
(Contract AT(40-1)-2847)
(GEMP-36A) OTS: $1.00

Further study of BeO specimens irradiated in low-flux, low-temperature exposures provided information that provides a relatively complete understanding of the flux and temperature dependence of irradiation expansion. The mechanism appears to be a first-order process involving radiation-enhanced diffusion with modifications stemming from the presence of defect clusters. Work was continued on the dissolution of Kr^{85} in arc-cast tantalum cathodes under self-sustaining glow discharge conditions. The attenuation of the beta emission from this isotope in tantalum was evaluated, and the construction of equipment to be used in fore-diffusion studies was begun. Coprecipitated F-227 fuel (UO_2-ThO_2-Y_2O_3 with a mole ratio of 1:1:0.55) developed a single-phase, well-crystallized structure when reacted for 4 to 10 hours at 1,900° C or 0.5 hours at 2,200° C in argon. The BeO fuel elements with UO_2-ThO_2-Y_2O_3 compositions show little or no UO_2 loss (based on weight change) in 1,000-hour fuel retention tests at 1,300° C and 1,400° C in air. No detrimental changes in density, grain size, or strength occurred in the test specimens. Author

N64-23280 Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
EFFECTS OF THERMAL RADIATION ON THE ACOUSTIC RESPONSE OF SOLID PROPELLANTS
R. H. Cantrell, F. T. Mc Cluren and R. W. Hart Jun. 1964 45 p refs
(Contract NOw-62-0604-c)
(TG-335-18)

Theoretical calculations are given for the propellant response function when thermal radiation of the burnt gases is taken into account. Under the assumption that the gas radiates as a gray body, it is found that radiation effects may significantly alter the response function at low frequencies for the low propellant burning rates that are commonly found at low frequencies for the low propellant burning rates that are commonly found at low pressures. Thus, this mechanism may offer a partial explanation of the fact that experimental values for the response function at low frequencies and low burning rates tend to be larger than is expected from existing theories. The method of calculation is based on a second-order perturbation scheme where the perturbation parameter is a measure of the ratio of energy transfer by radiation to convective energy transfer. Author

N64-23319 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INFLUENCE OF ASH-FORMING COMPONENTS IN LIQUID FUEL ON DETERIORATION OF GAS-TURBINE MATERIALS
R. F. Mocharnyuk (Acad. Sc. Ukr. SSR) *In its* Transactions of the Seminar on Heat-Resistant Materials 1959 p 45–64 refs (See N64-23316 16-01)

Vanadium, sulfur, and alkali components in a fuel, which produce V_2O_5, Na_2SO_4, and Na_2S during combustion, are important factors leading to catastrophic damage to gas turbines. At temperatures exceeding 650° C, corrosion takes place at a tremendous speed as a result of formation of low-melting compounds or eutectics from the oxide forming the ash (V_2O_5, Al_2O_3, and CaO) and oxides of the initial material. Of various materials studied, the most resistant to oxidation by liquid-fuel ash are nickel-based alloys. P.V.E.

N64-23320 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COMPARATIVE INVESTIGATION OF EROSION RESISTANCE OF HIGH-TEMPERATURE CORROSION-RESISTANT MATERIALS OF GAS TURBINES OPERATING ON SOLID FUEL
K. V. Olesevich (Odessa Polytechnic Inst.) *In its* Transactions of the Seminar on Heat-Resistant Materials 1959 p 65–75 refs (See N64-23316 16-01)

The general qualitative laws governing attrition of surfaces blasted by dust-bearing gas were investigated. In carrying out the experiments, the specimen was blasted with dust-bearing gas after the gas had been heated to high temperature (650° C), and the wear resistance of the material determined by its weight loss. P.V.E.

N64-23332 Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
PROCEDURES FOR FABRICATING ALUMINUM-BASE ATR FUEL ELEMENTS
R. J. Beaver, G. M. Adamson, and P. Patriarca, comp. Jun. 1964 78 p refs
(Contract W-7405-ENG-26)
(ORNL-3632) OTS: $2.00

One of the major objectives in the development of the curved plate, aluminum-base fuel element for the 250-mw Advanced Test Reactor was to determine whether relatively inexpensive fabrication techniques that are amenable to commercial manufacturing could be utilized in making this rather unique fuel element. The reactor fuel core is 48 in. long and contains 40 fuel elements in a serpentine fuel core arrangement. Nine high-flux regions are provided in the reactor. Because of this serpentine arrangement, each fuel element in cross section is wedge shaped, and each of the 19 plates in the fuel element has its own specific radius of curvature. This report describes in detail the fabrication techniques that were used successfully to make several fuel elements. Conventional powder metallurgical dry-blending techniques produced fuel compacts with homogeneous mixes of the U_3O_8, B_4C, and aluminum. More than 95% of the plates clad with type 6061 aluminum by hot roll bonding met specified dimensions. A modified marforming process shaped plates with acceptable radii of curvature. Extraordinarily close control of the spacings was achieved by assembling the plates between two grooved type 6061 aluminum side pieces and mechanically joining by use of roll-swaging techniques. Author

N64-23421 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TRANSIENTS IN THE BURNING OF POWDERS
B. V. Novozhilov 15 Mar. 1963 14 p ref Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 5, 1962 p 83–88
(FTD-TT-63-112/1+2+4; AD-401741)

Nonsteady-state processes during the transition of the burning of powder from one steady-state regime to another are discussed. By numerically solving the equations, time dependencies of the burning velocity, pressures in the chamber, and temperature profiles in the solid phase are determined. J.L.D.

N64-23422 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THERMAL DECOMPOSITION OF NITROSYL PERCHLORATE
V. Ya. Rosolovskiy 18 Mar. 1963 7 p refs Transl. into ENGLISH from Doklady Akad. Nauk SSSR (Moscow), v. 146, no. 1, 1962 p 115–117
(FTD-TT-63-116/1+2+4; AD-401739)

Solid nitrosyl perchlorate completely decomposes to gaseous substances above 120° C according to the equation $2NOClO_4 = N_2O_4 + Cl_2 + 3O_2$. The intermediate products are discussed, and it is concluded that the thermal decomposition of nitrosyl perchlorate proceeds in two stages with an intermediate formation of nitronium perchlorate, which is more stable than nitrosyl perchlorate. J.L.D.

N64-23426 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
UNSTABLE PERFORMANCE OF LIQUID FUEL ROCKET ENGINES
R. Staniszewski 27 May 1963 15 p refs Transl. into ENGLISH from Wojskowy Przeglad Lotniczy (Warsaw), no. 8, Aug. 1962 p 48–56
(FTD-TT-63-357/1+2; AD-411495)

The following causes for the unstable operation of rocket engines are discussed: (1) delay in ignition time; (2) external disturbances transmitted to the rocket engine; (3) change in

flight altitude; (4) change in flight velocity; (5) chamber and nozzle cooling; and (6) unstable operation of individual elements of the fuel feeding system. I.v.L.

N64-23476 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
KINETICS OF THE DARK REACTION OF THE CHLORINE HYDROGEN MIXTURE, 3 AND 4
A. I. Rozlovskiy 1 Apr. 1963 42 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 30, no. 11&12, 1956 p 2489–2498, 2713–2723
(FTD-TT-62-1688/1+2; AD-401591)

CONTENTS:
1. NORMAL COMBUSTION OF CHLORINE-HYDROGEN MIXTURES A. I. Rozlovskiy p 1–19 refs (See N64-23477 16-26)
2. KINETICS AND MECHANISM OF REACTION IN FLAME A. I. Rozlovskiy p 20–38 refs (See N64-23478 16-26)

N64-23477 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NORMAL COMBUSTION OF CHLORINE-HYDROGEN MIXTURES
A. I. Rozlovskiy *In its* Kinetics of the Dark Reaction of the Chlorine Hydrogen Mixture, 3 and 4 1 Apr. 1963 p 1–19 refs (See N64-23476 16-26)

The propagation of a spherical flame through chlorine–hydrogen mixtures in a glass flask at pressures from 35- to 260-mm Hg was studied. Thermodynamic calculations are presented for the combustion temperature and for the density change on combustion of chlorine–hydrogen mixtures as functions of the chlorine-to-hydrogen proportions, the pressure, the amount of combustion products added, and the variation of the content of the mixture's excess component. G.D.B.

N64-23478 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
KINETICS AND MECHANISM OF REACTION IN FLAME
A. I. Rozlovskiy *In its* Kinetics of the Dark Reaction of the Chlorine Hydrogen Mixture, 3 and 4 1 Apr. 1963 p 20–38 refs (See N64-23476 16-26)

The basic rate coefficient of the flame reaction, corrected to allow for the dependence of combustion temperature on pressure, corresponds to a reaction order of 1.5. The corrected temperature coefficient of the flame reaction rate in mixtures with excess chlorine corresponds to the effective activation-energy value. The influence of excess-component concentration on the reaction rate in the flame is severely distorted by side factors. G.D.B.

N64-23611* Bell Aerosystems Co., Buffalo, N.Y.
WELDED METAL BELLOWS, A RELIABLE POSITIVE EXPULSION DEVICE FOR LIQUID PROPELLANTS
Leo M. Thompson N.Y., AIAA [1964] 7 p Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(Contract NAS7-149)
(AIAA Paper-64-264) AIAA: $0.50 members, $1.00 nonmembers

The results of this parametric analysis demonstrated the superior potential of the metal bellows, and it was therefore selected for a comprehensive design study. The selection criteria included those conditions imposed during long-term orbital missions and spacecraft applications, including operations through a wide range of temperatures and high radiation levels. Low rates of permeation and diffusion through a gas–liquid barrier were also considered. Compatibility with selected propellants and the reliability associated with manned applications became important criteria for consideration. G.D.B.

N64-23630 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CALCULATING LOCAL DEFLECTIONS OF LRE COMBUSTION CHAMBER SHELLS
N. A. Alfutov *In its* Certain Problems of Mechanics 28 Aug. 1963 p 1–14 refs (See N64-23629 16-01)

The engineering method of calculating local deflections of an LRE chamber is based on the application of the Bubnov–Galerkin procedure to the numerical integration of the equations of sloping shell equilibrium operating beyond the elasticity limit. In spite of its relative simplicity, this method still leads to very cumbersome graph–analytical calculations. This article presents an energy method of calculating local deflections involving fewer calculations. The accuracy of the solution can be estimated, and the energy method is more convenient for data processing programing. G.D.B.

N64-23631 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONCERNING LOCAL STABILITY OF THE INNER WALL OF AN LRE CHAMBER
I. S. Zarubin *In its* Certain Probl. of Mech. 28 Aug. 1963 p 15–31 refs (See N64-23629 16-01)

Calculations were based on methods developed by V. I. Feodosyev to determine the strength of LRE shells. Longitudinal, spiral, and spot arrangements of the joints between the walls were considered. Decreasing the thickness of the inner wall increases its coolness, but decreases its local stability. This study is devoted to finding ways to satisfy these contradictory requirements. G.D.B.

N64-23909* National Aeronautics and Space Administration, Washington, D.C.
NASA ADVANCES LIQUID HYDROGEN USE AS SPACE FUEL
12 Jul. 1964 5 p
Available from the Scientific and Technical Information Division
(News Release No. 64-164)

The flight test of NASA's Centaur rocket succeeded in qualifying liquid hydrogen as a high-performance fuel for space exploration. Liquid hydrogen, when mixed with liquid oxygen in a rocket engine, produces about 35% more thrust than the kerosene-type fuels now being used. The potential of this fuel has long been known, but until now was not practical. This article discusses its advantages as rocket fuel from the viewpoints of heat, storage, weightlessness, production, and handling. G.D.B.

N64-23947* Douglas Aircraft Co., Inc., Newport Beach, Calif. Missile and Space Systems Div.
INVESTIGATION OF ZEOLITE MEMBRANE ELECTROLYTES FOR FUEL CELLS Final Rept.
C. Berger, F. C. Arrance, D. W. Cleaves, and M. J. Plizga Mar. 1964 155 p refs
(Contract NAS-7-150)
(NASA-CR-54023; Rept. 108F) OTS: $11.50 ph

This report concerns development efforts in establishing practical fuel-cell operating parameters, specifically, the development of a device capable of comparing on a quantitative basis the operability of various inorganic membranes. Among various materials investigated were zeolites. Experiments conducted included the following: bonding materials for inorganic fuel-cell membranes, membrane preparation by casting and pressing, analysis of transverse strength and electrical conductivity of phosphate bonded inorganic membranes, and plotting of mathematical results of processing variables. A.W.

N64-24010 Geophysics Corp. of America, Bedford, Mass.
ATMOSPHERIC TRANSPORT OF ROCKET MOTOR COMBUSTION BY-PRODUCTS Monthly Letter Progress Report
10 Jul. 1964 15 p
(Contract N123(61756)34567A/DMR)
(MLPR-9)

Work under the contract is divided into two phases. Phase A is concerned with studies of the atmospheric transport and dispersal of rocket motor combustion byproducts emitted during static firing tests and the establishment of the degree of land contamination to be expected during such tests. Under Phase B of the work, consulting services are provided to the Commander of the Pacific Missile Range in the general areas of micrometeorology and meteorological instrumentation.
Author

N64-24016* Lockheed Missiles and Space Co., Sunnyvale, Calif.
STAGE SEPARATION AND PROPELLANT DISPERSION ORDNANCE SUBSYSTEM Technical Note
[1963] 16 p refs
(Contracts NAS8-5600; NAS8-9500)
(NASA-CR-56647; NSP-64-28) OTS: $1.60 ph

The S-N Stage Ordnance system is comprised of two subsystems, the Propellant Dispersion Subsystem and, the Separation Subsystem. The system concepts presented herein are consistent with established Saturn vehicle design criteria. Common Ordnance components are used in each subsystem design. The designs are predicated on the concept that contained detonating fuze (CDF) components are installed in the Nuclear Assembly Building (NAB) where the stage contractor has maximum accessibility; installation and checkout of the flexible, linear shaped charges (FLSC), retro rockets, and live ordnance are planned for the Vehicle Assembly Building (VAB). Ordnance test programs are recommended for the establishment of reliable component performance in nuclear radiation environments.
Author

N64-24220 Avco-Everett Research Lab., Everett, Mass.
STUDIES OF SEED RECOVERY AND CORROSION IN COAL FIRED MHD POWER PLANTS
F. Hals, L. Keefe, and A. El Bindari Jun. 1964 35 p refs
(RR-182)

An easily ionizable material called seed must be added to the combustion products of fossil fuel in order to achieve a sufficient degree of ionization of the gases in the MHD generator. The problems of seed recovery and gas side corrosion effects due to seeding in coal-fired MHD powerplants are of critical importance for successful economic realization of MHD power generation. The purpose of this paper is to report the results of a study of these problems and to apply these results to an assessment of the economics of seeding in a coal-fired MHD powerplant. The paper contains a survey of the problems, a description of a potential recovery method and of apparatus to experimentally study the recovery method, as well as corrosive effects due to seeding of the steam generator and oxidizer preheater utilizing the heat in the exhaust gases from the MHD generator. It presents experimental results indicating that efficient seed recovery is feasible with resultant favorable seed economics.
Author

27 PROPULSION

Includes airbreathing, electric, liquid, nuclear, and solid propulsion. *For related information see*: 04 Aircraft; 06 Auxiliary Systems; 26 Propellants and Combustion; and 30 Space Vehicles.

N64-22895 Rensselaer Polytechnic Inst., Troy, N.Y.
PROPULSION OF A VEHICLE IN A TUBE
Joseph V. Foa Jun. 1964 58 p refs
(Grant DA-ORD-31-124-61-G88)
(TR-AE-6404; AD-441302)

This study concerns the flow disturbances and energy transformations that a vehicle traveling in a tube produces in the adjacent columns of air. The analysis accounts for compressibility, friction, and heat exhanges. The results are applied to the calculation of the power required in relation to blockage ratio, vehicle speed, and mode of propulsion. At the higher speeds, the power required depends very critically on the mode of propulsion.
Author

N64-22949 Atomics International, Canoga Park, Calif.
APPLICATION OF SNAP REACTOR POWER SYSTEMS TO MANNED SPACE STATIONS
15 Jun. 1964 116 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-9715) OTS: $2.25

Manned space laboratories and stations will require sizable amounts of on-board electric power to perform their life-support, guidance and control, communications, and operational functions. Nuclear power systems currently under development offer many advantages as prime power sources for these laboratories and stations, i.e., a high power-to-weight ratio, low radiator areas and therefore low drag and minimum propellant inventory for station keeping in low-earth orbit (150 to 350 nmi), no effect on power production during the sun-shade orbital transient, no complex sun orientation required during the sun portion of the orbit, etc. The SNAP nuclear power system, offering the most potential for these applications in the 5-kw to few-hundred-kw power range with lifetimes greater than several weeks, is the zirconium–hydride–uranium thermal reactor coupled through a NaK loop to a Mercury–Rankine power-conversion system. This system is currently under development and could be ready by the 1970 to 1980 decade. Preliminary designs of this system at 5-, 10-, 15-, and 20-kwe power levels give unshielded system weights (including one redundant power conversion system) of 1,850, 2,530, 3,230, and 3,940 lb, respectively. Shielding for 90-day on-orbit stay time in a 10-ft-diam space station results in total plant weight, for these power levels, of 4,310, 5,040, 5,760, and 6,470 lb.
Author

N64-23197* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio TRW Electromechanical Div.
PROPELLANT FLOW METER FOR ION ROCKET SYSTEMS Final Report
Keith M. Montgomery 15 Jun. 1964 115 p refs
(Contract NAS3-2515)
(NASA-CR-54070; TRW-ER-5923) OTS: $9.60 ph

A heated fin anemometer vapor flow meter was designed to operate over a flow range of 10^{-4} to 5×10^{-2} gms/sec with either cesium or mercury vapor at 840° F. A calibration system was developed that consisted of a boiler, superheater, metering orifice, desuperheater, and condenser. The design of the anemometer configuration was accomplished with the aid of a digital computer. The expected flow-rate response of the meter was obtained. In the low-flow-rate range (10^{-4} to 10^{-3} gms/sec) the accuracy of the meter was limited by a drift on the meter readout. A discussion of this drift and suggestions for reducing it are included in the report. Author

N64-23231* National Aeronautics and Space Administration, Washington, D.C.
A SUMMARY OF NUCLEAR ROCKET APPLICATIONS
Paul G. Johnson [1964] 8 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964 Prepared in Cooperation with AEC
(AIAA Paper-64-388) AIAA: $0.50 members, $1.00 nonmembers

This summary of nuclear rocket applications emphasizes that nuclear rocket propulsion offers significant advantages in the next round of space exploration missions beyond Apollo. Nuclear rockets should be seriously considered for all new major vehicle stages. Manned planetary missions, as well as manned lunar missions, will benefit from nuclear rockets. Unmanned missions with large payloads can benefit greatly from this method also. G.D.B.

N64-23252 Columbia U., New York, N.Y. Plasma Lab.
ON A GASEOUS NUCLEAR ROCKET WITH MHD VORTEX FUEL CONTAINMENT
K. O. Kessey and R. A. Gross Oct. 1963 37 p refs
(Contract AF 49(638)-1254)
(Rept.-6; AFOSR-64-0570; AD-436083)

The use of a hydromagnetically driven vortex as a means of separating fuel from propellant in a gaseous nuclear rocket is examined for configurations of practical interest. Theoretical limitations are given on the radial mass flow rate for steady flow. The simultaneous compatible conditions of electric power, magnetic field strength, fuel-propellant composition (U^{235} as fuel and hydrogen as propellant) and inlet composition are determined for steady separation in a critical system. Transport properties are estimated at 1 ev using kinetic theory. Reactor power requirements and thrust produced by several systems are determined. Author

N64-23346* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
OFF-DESIGN PERFORMANCE OF HYPERSONIC SUPERSONIC COMBUSTION RAMJETS
Leo C. Franciscus N.Y., AIAA [1964] 7 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jul.–2 Jul. 1964 Previously Published as NASA-TM-X-52032; see N64-20578 13-27
(NASA-TM-X-52032; AIAA Paper-64-248) AIAA: $0.50 members, $1.00 nonmembers

A performance study of fixed-geometry two-dimensional supersonic combustion ramjets was undertaken to determine the relative importance of various losses and the effect of the engine geometry on the losses. Results of the study have shown that friction losses are large and can account for as much as 34-percent reduction in fuel specific impulse at Mach 20. Nozzle dissociation losses are relatively small and amount to 6 percent of the ideal specific impulse at Mach 20. The performance trade-offs indicate that the avoidance of large inlet shock and nozzle divergence losses, attained with the use of small inlet wedge and nozzle divergence angles, results in large viscous losses. N.E.A.

N64-23347* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RECENT NASA EXPERIENCE WITH HYDROGEN ENGINES
Leland F. Belew, Floyd M. Drummond, and Rodney D. Stewart N.Y., AIAA [1964] 8 p Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-270) OTS: $0.50 member, $1.00 nonmember

This paper presents a review of the experience accumulated in the development of the liquid hydrogen J-2 and RL10 rocket engines. A brief description of the configuration, performance, and operation of each engine is presented, followed by a description of recent progress in areas that are unique to liquid hydrogen burning engines and, in particular, to engines that must operate in the environmental conditions encountered in the second or third stage of a space vehicle. Author

N64-23519* Lockheed Missiles and Space Co., Sunnyvale, Calif.
RIFT NRDS OPERATIONS PLAN
A. J. Steele Apr. 1964 143 p refs
(Contracts NAS8-5600; NAS8-9500)
(NASA-CR-56561; NSP-64-24; Rept.-504) OTS: $11.00 ph

The plans for carrying out the RIFT Stage Captive Test Program at the Nuclear Rocket Development Station (NRDS) in Nevada are described. The following are discussed: (1) objectives of the program, governing policies, directives, and assumptions; (2) the Nuclear Rocket Development Station; (3) facilities test equipment, and test articles; (4) organization; and (5) concept and sequence of operations. R.T.K.

N64-23875 Garrett Corp., Phoenix, Ariz.
SNAP 50/SPUR POWER SYSTEM Quarterly Technical Progress Report, Period Ending Apr. 30, 1964
18 May 1964 114 p
(Contract AF 33(615)-1551)
(APS-5090-RI; AD-440789)

The major technical areas described are materials development, liquid-potassium bearing tests, turbomachinery tests, model generator, insulation system, full-scale generator, generator rotor, heat-transfer components, potassium boilers, condenser design, and analysis of the control system. These are continuing tasks of the SPUR program. G.D.B.

N64-23879 Air Force Systems Command, Edwards AFB, Calif. Rocket Propulsion Lab.
REPORT BIBLIOGRAPHY: AIR FORCE ROCKET PROPULSION LABORATORY, JANUARY 1958 TO MARCH 1964
Jane H. Womack, comp. [Mar. 1964] 229 p refs
(RPL-TDR-64-53; AD-442118)

A comprehensive listing is presented of all pertinent reports. A.W.

N64-23887 AiResearch Mfg. Co., Phoenix, Ariz.
SNAP 50/SPUR POWER SYSTEM Annual Summary Report, Period Ending Dec. 31, 1963
J. H. Dannan Jan. 31, 1964 166 p refs
(Contracts AF 33(657)-8954; AF 33(657)-10922)
(APS-5071-R; AD-439687)

This report describes work conducted on the space-power-unit reactor program (SPUR). Analytical and experimental studies for 17 tasks are reported as to progress made. Included in the discussion is development of materials, bearings, turbine, generator, and heat transfer. The report is well illustrated. G.D.B.

N64-23940* Lockheed Missiles and Space Co., Sunnyvale, Calif.
PTF AND FACILITIES
21 May 1963 16 p Presented at the RIFT Mfg. Eng. Working Group Meeting
(Contract NAS8-5600)
(NASA-CR-56311; NSP-63-61) OTS: $1.60 ph

The booklet contains a series of selected charts depicting areas relative to program planning of the propellant-tank-fabrication facility to be used in the RIFT manufacturing operational functions. A.W.

N64-23943* Aerojet-General Corp., Sacramento, Calif.
INVESTIGATION OF SYSTEM COMPONENTS FOR HIGH CHAMBER PRESSURE ENGINES. PART 2: APPENDIXES Final Report
May 1964 141 p refs
(Contract NAS8-5329)
(NASA-CR-56306; Rept.-5329-F) OTS: $11.00 ph

These appendixes include information on Government contracts applicable to seal technology, valve pressure-drop calculations, valve size and weight calculations, design of venturi sections for individual valves, seal and bearing X-ray determinations, parametric study of line material properties, heat-exchanger design for the AJ-1 engine, and a bibliography. G.D.B.

N64-24017* Lockheed Missiles and Space Co., Sunnyvale, Calif.
RIFT SYSTEMS ANALYSIS. VOLUME 3: AERODYNAMICS Report 201
A. J. Steele and H. F. Plank Nov. 1963 117 p refs
(Contract NAS8-5600)
(NASA-CR-56646; NSP-63-96, Vol. 3) OTS: $9.60 ph

This volume presents the results of aerodynamic analysis for the Saturn VN launch vehicles, both RIFT and operational, which are applicable to the 176,000-lb impulse propellant capacity S-N stage. The aerodynamic characteristics are obtained by a combination of theoretical methods and available scale-model experimental test data. The information included here covers aerodynamic data for the areas of stability and control, performance, and drag; data for structural design; data for ground transporter design; and jet wake characteristics of secondary propulsion systems. Author

N64-24030* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
ELECTROSTATIC THRUSTORS FOR SPACE PROPULSION, PRESENT AND FUTURE
William R. Mickelsen and Harold R. Kaufman [1963] 71 p refs Presented at Brit. Interplanet. Soc. Symp. on Advanced Propulsion Systems, London, 9 Oct. 1963
(NASA-TMX-51764) OTS: $7.50 ph

Electrostatic thrustors are components of electric propulsion systems now being developed for space vehicles. The paper examines an existing experimental thrustor, states a number of deficiencies in it, gives reasons for these shortcomings in terms of the basic physical processes for each thrustor type, and summarizes research and development programs on these problems. A.W.

N64-24166* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
PRELIMINARY ANALYSIS OF MANNED MARS MISSION USING ELECTRIC PROPULSION SYSTEMS
John S. Mac Kay N.Y., AIAA [1964] 8 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-498) AIAA: $0.50 members, $1.00 nonmembers

Comparisons with the all-nuclear rocket system and the combined nuclear and electric rocket system show that the combined system is superior over a wide range of mission times at a specific powerplant mass of 7 kg/kw. The electric system becomes equivalent to the combined system at the longer mission times and is superior to the nuclear rocket system. For the shorter mission times, however, the combined system is far superior to others. J.L.D.

N64-24167* Giannini Scientific Corp., Santa Ana, Calif.
DEVELOPMENT STATUS OF LOW POWER ARC-JET ENGINES AND THEIR APPLICABILITY TO NEAR FUTURE SPACE MISSIONS
W. A. Geideman, Jr., K. Muller, and J. W. Rosenbery N.Y., AIAA [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(Contract NAS3-2521)
(AIAA Paper-64-502) AIAA: $0.50 members, $1.00 nonmembers

The results described demonstrate the possibility of developing low-power arc-jet thrustors capable of continuous operation for 500 to 1,000 hours. It also appears quite feasible to improve both specific impulse and efficiency through refinements in the present design and the use of regenerative cooling techniques. These improvements would advance the low-power arcjet into the category of practical engines for near-future space vehicles with solar-cell power supplies. Author

N64-24168* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRIC PROPULSION IN 1964—A STATUS REVIEW
Ernst Stuhlinger N.Y., AIAA [1964] 8 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D. C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-524) AIAA: $0.50 members, $1.00 nonmembers

Progress is reported in electrothermal and electrodynamic systems; the advancement of the Kaufman ion engine is noted, together with the development of two new thrustors—the thermoionic thrustor and the annular Hall-current accelerator. A.W.

N64-24169* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENTS IN ENTRY VEHICLE TECHNOLOGY
Alvin Seiff [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, Washington, 29 Jun.–2 Jul. 1964
(AIAA Paper-64-528) AIAA: $0.50 members, $1.00 nonmembers

Discussed are entry-vehicle problems related to Mars entry of an unmanned probe and to Earth entry well above the escape speed. Some recent laboratory research findings related to high-speed entry problems are summarized. Design for steep entry into some of the proposed Mars atmospheres appears to be unfeasible because of the extremely low m/C_DA required for soft landing. Hence, missions to search for life on Mars and to make physical measurements of the Martian surface cannot be confidently undertaken until the questions about the atmosphere are resolved. For entry into planetary atmospheres at speeds much greater than 40,000 fps, use of entry vehicles with all surfaces swept back relative to the stream (such as cones) is indicated to prevent radiative heat transfer from becoming castastrophically large. Items selected from recent research are related to cone radiative heating at high speeds, combustion of ablation shields, ablation products radiation, injected gas interaction with the external flow, and atmospheric gas radiation of nitrogen–carbon-dioxide mixtures.

Author

N64-24188 Giannini Scientific Corp., Santa Ana, Calif.
30 KW ARC-JET THRUSTOR RESEARCH Technical Documentary Report, 19 Nov.–19 Jan. 1964
James P. Todd Wright-Patterson AFB, AF Aero Propulsion Lab., Mar. 1964 121 p refs
(Contract AF 33(657)-10338)
(FR024-10338; APL-TDR-64-58; AD-601534)

An experimental radiation-cooled, hydrogen-propelled thrustor designed previously had demonstrated a high level of performance with a lifetime greater than 100 hr. The current program, a continued effort at the 30-kw power level, required the attainment of improved performance characteristics ($\eta \geq$ 55% at Isp = 1000 secs) and a lifetime demonstration of 500 hr. To attain these difficult performance requirements, a thrustor having a regeneratively cooled anode–nozzle was designed, which maintained as closely as possible the internal geometry that had performed successfully in the previous program. The successful completion of a continuous 500-hr endurance test at the required operating conditions without failure indicates that this 30-kw arcjet thrustor is as advanced as any other type of electric propulsion system at this time.

Author

N64-24215 Air Force Systems Command, Wright-Patterson AFB, Ohio Aero Propulsion Lab.
DISCUSSION OF INLET EFFICIENCY PARAMETERS
E. T. Curran and M. Brian Bergsten Apr. 1963 73 p refs
(ASRPR-TM-62-68; AD-601482)

The various definitions of intake efficiency currently in use for supersonic combustion ramjet engines are surveyed. Derivations of each of these parameters and the relationships between them are presented. A number of charts for conversion from one efficiency parameter to another are included. These charts are based on real gas properties. Attention is drawn to the application of available energy concepts to the supersonic-combustion ramjet engine, and a definition of intake effectiveness is introduced.

Author

28 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. *For related information see*: 05 Astronomy and Astrophysics; 16 Life Sciences; and 29 Space Sciences.

N64-22770* California U., Berkeley
THE REFLECTION AND EMISSION OF ELECTROMAGNETIC RADIATION BY PLANETARY SURFACES AND CLOUDS
D. G. Rea and W. J. Welch 26 Jul. 1963 90 p refs
(Grants NsG-101-61; NSF G-16741)
(NASA-CR-52222) OTS: $8.10 ph

A review of data dealing with the reflection and emission of electromagnetic radiation by planetary surfaces and clouds is presented. Only quantitative observations possessing a certain amount of spectral resolution are considered. Theoretical considerations are developed for reflection and emission by plane surfaces, layered surfaces, rough surfaces, and clouds. The radiometric determination of planetary temperatures is also discussed. Reflection and emission observations of the following planetary bodies are considered: (1) Moon—visible region, radar reflections, infrared region, and microwave region; (2) Mercury—infrared, radio waves, and radar; (3) Venus—visible and near infrared, infrared, passive microwave, and radar; (4) Mars—visible region, infrared region, and microwave; and (5) major planets (Jupiter and Saturn)—radio waves.

P.V.E.

N64-22797 Joint Publications Research Service, Washington, D.C.
THE USE OF PENETRATING COSMIC RADIATION FOR DETERMINATION OF MEAN ROCK-DENSITY VALUES
V. M. Bondarenko and A. G. Tarkhov 16 Jun. 1964 10 p refs Transl. into ENGLISH from Razvedka i Okhrana Nedr (Moscow), no. 4, 1964 p 30–34
(JPRS-25104; OTS-64-31494) OTS: $0.50

This article gives a brief description of the apparatus, methods, and information concerning the determination of rock-density values based on observations of cosmic radiation in mine workings. Also given are the results of combining PRKI with underground gravity surveys. The recording of a cosmic radiation was performed with telescopes of gas-filled and scintillation counters.

G.D.B.

N64-22930* National Aeronautics and Space Administration, Washington, D.C.
INVESTIGATION OF THE MAGNETIC FIELD IN SPACE [ISSLEDOVANIYE MAGNITNOGO POLYA V KOSMICHESKOM PROSTRANSTVE]
Sh. Sh. Dolginov and N. V. Pushkov Nov. 1963 66 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 1, Jul.–Aug. 1963 p 55–97
(NASA-TT-F-8562)

A survey is presented of the experimental data on the magnetic field of the earth, the moon, and interplanetary space, obtained by earth satellites and space rockets in the Soviet Union and in the United States. Compared are results of the measurements performed in the immediate vicinity of the earth, in the outer radiation belt, and at the boundary of the geomagnetic field, on magnetically quiet and perturbed days, and on the day and night sides of the earth.

J.L.D.

N64-22932* National Aeronautics and Space Administration, Washington, D.C.
RADIATION OF SOFT X-RAYS BY THE SOLAR CORONA [OB IZLUCHENII SOLNECHNOY KORONY v MYAKOV RENTGENOVSKOY OBLASTI]
Ye. P. Fetisov Feb. 1964 14 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, Sep.–Oct. 1963 p 209–215
(NASA-TT-F-8811)

This work is devoted to the determination of the radiation flux of the solar corona in the spectral region shorter than 10 A. The concentrations of ions of the most prevalent elements are computed in the temperature interval of $1 \cdot 10^6$ °K to $4.5 \cdot 10^6$ °K. Radiation fluxes are obtained for free-free and free-bound transitions, as well as for radiations in the lines. In the temperature range of $1 \cdot 10^{6\circ}$ to $3 \cdot 10^{6\circ}$, the radiation is due primarily to the recombination of the ions of heavy elements. Calculations were carried out with the use of an electronic computer. Author

N64-22939* National Aeronautics and Space Administration, Washington, D.C.

INVESTIGATION OF COSMIC RADIATION BEYOND THE ATMOSPHERE [ISSLEDOVANIYE KOSMICHESKOGO IZLUCHENIYA ZA PREDELAMI ATMOSFERY]

N. L. Grigorov, D. A. Zhuravlev, M. A. Kondrat'yeva, I. D. Rapoport, and I. A. Savenko Feb. 1964 12 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 1, no. 3, 1963 p 436–442
(NASA-TT-F-8831)

The measurements of the traces of charged particles in an emulsion irradiated at an altitude of 306 to 339 km revealed that the intensity of the recorded radiation was three times as high as that of the primary cosmic radiation. About 50% of the excessive particles are not nuclear-active and are characterized by a minimum ionization (probably electrons). The other particles are heavily ionizing particles representing nuclear disintegration products. Author

N64-22942* National Aeronautics and Space Administration, Washington, D.C.

INDICATIONS OF SOLAR ACTIVITY FROM THE ANNUAL RINGS OF "PINUS TARNOCIENZICA" OF THE MIOCENE PERIOD [OTRAZHENIYE SOLNECHNOY AKTIVNOSTI NA GODICHNYKH KOL'TSAKH "PINUSA TARNOTSIYENZISA" IZ EPOKHI MIOTSENA]

M. Baktai, I. Feyesh, and A. Khorvat Jun. 1964 4 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 41, no. 2, 1964 p 413–414
(NASA-TT-F-9011)

Measurements were made of the width of the annual rings of a polished cross section of petrified *Pinus tarnocienzica*. Regular fluctuations in the growth of the tree were observed. It is proposed that these fluctuations reflect the variation in solar activity during the period of growth. If this proposition is true, then the period of solar activity during the life of this tree was rather short—approximately 7 years. I.v.L.

N64-23012 Utah U., Salt Lake City

SATELLITE INDUCED RADIATION BY O^+ RECOMBINATION

Alvin M. Despain *In its* Aerospace Vehicle Detection Studies [1964] 10 p (See N64-23008 16-15)

It is suggested that perhaps an otherwise passive satellite could induce recombinations of the ambient electrons and ions, thereby releasing energy. This energy, if of suitable magnitude and spectral character, could then be detected, thus revealing the presence of a passive satellite. An attempt is made to estimate the energy that could possibly be released by such a mechanism. P.V.E.

N64-23048* National Aeronautics and Space Administration, Washington, D.C.

SOLAR CORPUSCULAR STREAMS AND GEOMAGNETIC STORM FAMILIES DURING THE FLIGHT OF MARINER 2 [SOLNECHNYYE KORPUSKULYARNYYE POTOKI I SEMEYSTVA GEOMAGNITNYKH BUR' VO VREMYA POLETA MARINER-2]

V. I. Afanas'yeva Jun. 1964 14 p refs Transl. into ENGLISH from Geomagnetizm i Aerononiya (Moscow), v. 4, no. 1, 1964 p 34–40
(NASA-TT-F-8877)

The data of plasma measurements made by Mariner 2 have been used to verify a hypothesis concerning families of geomagnetic storms. The results obtained show that a family of geomagnetic storms may be connected with the interaction between an individual solar corpuscular stream and the geomagnetic field. Such a stream, passing Mariner 2, produced an increase in the plasma velocity registered by the spacecraft. Author

N64-23054* National Aeronautics and Space Administration, Washington, D.C.

INCREASE IN COSMIC RAY INTENSITY IN THE HARD COMPONENT DURING "SMALL" CHROMOSPHERIC FLARES ON THE SUN [UVELICHENIYE INTENSIVNOSTI KOSMICHESKIKH LUCHEY V ZHESTKOY KOMPONENTE VO VREMYA "MALYKH" KHROMOSFERNYKH VSPYSHEK NA SOLNTSE]

L. I. Dorman, V. I. Ivanov, and Ye. V. Kolomeyets Jun. 1964 7 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 4, no. 2, 1964 p 399–401
(NASA-TT-F-9005)

Investigated was the effect of small chromospheric flares in the neutron component of cosmic rays, with the objective of extending the spectrum of solar particles into the high energy region. There are two viewpoints concerning the effect of small flares in the hard component—the increase of intensity is determined by meteorological factors, and the cause of the effect is the generation of relativistic particles during a chromospheric flare. G.D.B.

N64-23119* National Aeronautics and Space Administration, Washington, D.C.

STRUCTURAL CHARACTERISTICS OF THE RADIATION FIELD OF THE EARTH AS A PLANET [STRUKTURNYYE KHARAKTERISTIKI POLYA IZLUCHENIYA ZEMLI KAK PLANETY]

Ye. P. Borisenkov, Yu. P. Doronin, and K. Ya. Kondrat'yev Oct. 1963 20 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 1, 1963 p 113–125 Previously Published as N64-21631 15-12
(NASA-TT-F-8564)

This article presents the results of a statistical investigation of the outgoing radiation fields from the data obtained with Tiros II. Structural and correlation functions are constructed for each of the 52 orbits based on data published in the United States. The average and most probable values of these functions are obtained, taking into account errors in the measurement of the outgoing radiation. The feasibility of accepting the isotropy of the analyzed fields is investigated. A comparison is made of the structural characteristics of the fields of the integral outgoing radiation with the outgoing radiation in the region of the atmospheric window. Author

N64-23130* National Aeronautics and Space Administration, Washington, D.C.

RADIATION OF THE SOLAR CORONA IN THE SPECTRAL REGION WITH $\lambda < 10$ A [IZLUCHENIYE SOLNECHNOY KORONY V OBLASTI SPEKTRA KOROCHE 10A]

Ye. P. Fetisov Jun. 1964 5 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 41, no. 2, 1964 p 299–301 (NASA-TT-F-9009)

The spectral radiation flux of the corona at $\lambda < 10$ A was computed theoretically. Line emission, radiative recombination, and bremstrahlung are considered. Continuous emission from recombinations of heavy ions predominates. The theoretical flux is smaller than that observed, which indicates that the corona is highly nonhomogeneous. Author

N64-23173 Rochester U., N.Y.

THE ISOTOPIC COMPOSITION AND THE ENERGY SPECTRUM OF LOW ENERGY HELIUM NUCLEI IN PRIMARY COSMIC RADIATION

C. Dahanayake, M. F. Kaplon, and P. J. Lavakare 10 Apr. 1964 52 p refs Submitted for Publication
(Sponsored in Part by NASA and AF)
(URPA-31)

The isotopic composition and the energy spectrum of low energy helium nuclei were investigated using a nuclear emulsion stack. The proportion of He^3 nuclei at the top of the atmosphere was determined to be $18 \pm 5\%$ within the kinetic energy interval of 160 to 370 Mev/nucleon and $24 \pm 8\%$ within the rigidity interval 1.1 to 1.4 Bv/c. The differential energy spectrum in the above energy interval had a maximum around 275 to 300 Mev/nucleon. Assuming that there is no He^3 at the cosmic ray sources and that the observed abundance reflects the interactions of the primary radiation in its passage through interstellar matter, the conclusion is that the low energy primary radiation has traveled a total of 6 $\pm$ 2 gms/cm^2 in this medium; this is consistent with the values obtained from the low-energy lithium, beryllium, and boron experiment. The implications of these results are examined on the basis of different models used for the propagation of cosmic radiation through interstellar matter. Author

N64-23214 Uppsala U. (Sweden) Inst. of Physics

COSMIC RAY INTENSITY VARIATIONS DURING 1963

A. E. Sandström, E. Dyring, L. Ekström, B. O. Grönkvist, S. Lindgren et al 15 Mar. 1964 32 p refs
(Contract AF 61(052)-614)
(TN-3)

During 1963, the recorders continued in Uppsala and Kiruna by one neutron monitor, two cubical telescopes, and six inclined telescopes. Tables and figures give a detailed account of diurnal and semidiurnal variations during the year. A sharp phase shift in the semidiurnal variation can be found for the neutron monitor. Five decreases are illustrated by bihourly diagrams. Author

N64-23218* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ALBEDO AND EARTH RADIATION DEDUCED FROM EMISSIVITY SENSORS ON THE FIRST ORBITING SOLAR OBSERVATORY

John P. Millard and Carr B. Neel N.Y., AIAA [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-317) AIAA $0.50 members, $1.00 nonmembers

The emissivity experiment on the first Orbiting Solar Observatory yields, as part of the data on the stability of temperature-control coatings in space, information on earth-reflected sunlight and earth-emitted energy. Localized values of both albedo and earth radiation deduced from these data are presented. Descriptions of the experiment and radiometric technique, a comparison of the resultant values with other reported data, and an analysis of possible error associated with the results are included. Author

N64-23229 National Aeronautics and Space Administration, Washington, D.C.

NASA PARTICLES AND FIELDS SPACECRAFT

Eugene Ehrlich N.Y., AIAA [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-337) AIAA: $0.50 members, $1.00 nonmembers

NASA's unmanned-scientific-spacecraft program has resulted in the measurement and study of energetic particles (electrons, protons, alpha particles, and heavy nuclei). The importance of obtaining more data concerning these particles and their effect on the magnetic field initiated a program for the design, development, and flight of spacecraft containing the necessary instruments. These spacecraft are called Energetic Particle Explorers, Interplanetary Explorers, and Pioneer. This paper compares these spacecraft from the aspects of developmental history, major components, stabilization, power, communications, and magnetic cleanliness (elimination of magnetic materials or current carrying loops within the spacecraft as much as possible). Significant engineering features are compared in tables, and results to date are given. E.K.R.

N64-23265 California U., Livermore Lawrence Radiation Lab.

SOME ELECTRON SPECTRA IN THE RADIATION BELTS IN THE FALL OF 1962

H. I. West, Jr., L. G. Mann, and S. D. Bloom 13 Apr. 1964 42 p refs
(Contract W-7405-ENG-48)
(UCRL-7659) OTS: $1.00

A five-channel magnetic electron spectrometer was flown on USAF satellite 1962 βk. Energy channels were provided at 325, 955, 1,630, 2,400, and 3,250 Kev. Background was determined from two background channels and from the pitch-angle distributions of the data. Representative spectra were obtained for most of the regions of the geomagnetosphere. The electron spectra were strongly L-dependent, but usually only slightly B-dependent. Low L-shell data showed a high-energy spectrum characteristic of the injection of fission debris electrons from the Starfish nuclear explosion. The spectra softened with increasing L. Peak fluxes at $L \sim 1.3$ were about 4×10^8 electrons/cm^2-sec for electrons > 300 Kev. In December an inventory of electrons > 300 Kev for $L < 1.7$ was $4.4 \pm 1.3 \times 10^{24}$. The peak of the outer belt at $L \sim 4.5$ showed spectra that can be presented very approximately as an exponential falling off a factor of e in about 600 Kev. At $\lambda \sim 50°$ a typical quiet-period flux for electrons > 300 Kev was 7.7×10^6, electrons/cm^2-sec. Transiently trapped electrons were observed. These are electrons that will be precipitated when they drift eastward into the region of the magnetic anomaly in the earth's field. The pitch-angle distributions of these electrons are usually very strongly energy dependent, narrowing with increasing energy. The region $L = 1.6$ to 1.8 also shows marked energy dependence of the pitch-angle distributions. In such regions the spectrum is dependent upon pitch angle. Author

N64-23783 Joint Publications Research Service, Washington, D.C.
IZVESTIYA VUZOV: RADIOPHYSICS
18 May 1964 287 p refs Transl. into ENGLISH of Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gor'kiy), v. 6, no. 6, Nov.–Dec. 1963 p 1087–1283
(JPRS-24-633; OTS-64-31275) OTS: $5.00

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21. CONCERNING THE METHOD OF PRECISION MEASUREMENTS WITH THE AID OF AN "ARTIFICIAL MOON" N. M. Tseytlin p 268–274 refs (See N64-23804 16-05)

22. SOME FEATURES OF THE RADIATION FIELD OF A CHARGED PARTICLE IN A MOVING MEDIUM S. N. Stolyarov p 275–280 refs (See N64-23805 16-28)

23. WIDTH OF SPECTRAL LINE OF SOME LOW FREQUENCY AND RADIO FREQUENCY OSCILLATORS D. A. Dmitrenko and A. I. Chikin p 281–284 refs (See N64-23806 16-08)

24. SIMPLE THERMOSTAT FOR MASER RESONATOR G. M. Strakhovskiy and V. M. Tatarenkov p 285–288 ref (See N64-23807 16-25)

25. MASER WITH TWO TYPES OF NATURAL OSCILLATIONS OF THE RESONATOR V. A. Shcheglov p 289–296 refs (See N64-23808 16-25)

26. MOLECULAR GENERATOR WITH TWO SERIES CAVITIES USING AMMONIA $N^{14}H_3$ (3, 2 LINE) G. M. Strakhovskiy, V. M. Tatarenkov, and O. A. Tumanov p 297–299 refs (See N64-23809 16-25)

N64-23787 Joint Publications Research Service, Washington, D.C.
EFFECT OF MEDIUM ON CYCLOTRON ACCELERATION OF RELATIVISTIC PARTICLES
A. K. Gaylitis and V. N. Tsytovich *In its* Izv. VUZov: Radiophys. 18 May 1964 p 26–42 refs (See N64-23783 16-28) OTS: $5.00

The acceleration of relativistic electrons moving in a medium in the presence of a magnetic field under the action of transverse Electromagnetic waves is considered. The case of small frequencies is analyzed, i.e., $\omega < \omega_0\ \epsilon/m$ (where ω_0 is a plasma frequency, ϵ is the particle energy, m is its mass, $\hbar = c = 1$). Possible applications are discussed concerning the problem of relativistic electron acceleration in discrete radio sources. Author

N64-23805 Joint Publications Research Service, Washington, D.C.
SOME FEATURES OF THE RADIATION FIELD OF A CHARGED PARTICLE IN A MOVING MEDIUM
S. N. Stolyarov *In its* Izv. VUZov: Radiophys. 18 May 1964 p 275–280 refs (See N64-23783 16-28) OTS: $5.00

Phenomena occurring in moving bounded and unbounded media are discussed. The Valivova–Cerenkov radiation occurring when a charge moves in the medium, or in the medium of the transition radiation on the boundary, may turn out to be useful for an experimental study of relativisitic streams of clusters of charged particles, and also for some problems in astrophysics. G.D.B.

N64-23859 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RADIO EMISSION FROM SHOCK WAVES AT THE EARTH AND IN INTERPLANETARY GAS
M. A. Gintsburg *In its* Cosmic Res. 27 Apr. 1964 p 96–108 refs (See N64-23852 16-29)

Consideration is given to a new effect, radio emission in the range 10 to 30 kc, which must issue from a head

shock wave near to the earth or another planet. The intensity of this radiation permits raising the question of its experimental detection. Reference is also made to other effects resulting from a shock wave: acceleration of particles by oblique, isolated impulses (the Fermi mechanism), capture, and acceleration by plasma waves. Author

N64-23864 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SOME RESULTS OF RADIOMETRIC MEASUREMENTS AT ALTITUDES OF 200–400 KM FROM 1960–1963
S. N. Vernov, I. A. Savenko, P. I. Shavrin, V. Ye. Nesterov, N. F. Pisarenko et al *In its* Cosmic Res. 27 Apr. 1964 p 216–235 refs (See N64-23852 16-29)

The daily values of the doses for different flight trajectories and the dependence of the mean daily intensity caused by the radiation belts on height are determined. A change of the daily cosmic radiation intensity connected with the 11-year cycle of solar activity was detected, which indicates the genetic relationship of an excess with the primary cosmic rays. The lifetime of particles in an artificial belt with mirror points located at heights of 300 to 400 km was evaluated. Author

N64-23866 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MEASURING SOFT RADIATION IN THE EQUATORIAL LATITUDES ON COSMOS-4
I. A. Savenko, P. I. Shavrin, N. F. Pisarenko, V. Ye. Mesterov, M. V. Tel'tsov et al *In its* Cosmic Res. 27 Apr. 1964 p 240–247 refs (See N64-23852 16-29)

A scintillation counter on the Soviet artificial earth satellite Cosmos-4 recorded soft corpuscular radiation in the region of the cosmic ray equator. Analysis of the data shows that this is electrons with energies greater than $3 \cdot 10^4$ ev. The intensity of the recorded fluxes varied within 10^2 to 10^5 particles $\cdot$ $cm^{-2} \cdot sec^{-1}$. Author

N64-23928* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEW EVIDENCE FOR LONG-LIVED SOLAR STREAMS IN INTERPLANETARY SPACE
D. A. Bryant, T. L. Cline, U. D. Desai, and F. B. Mc Donald Jul. 1963 10 p
(NASA-TM-X-55029; X-611-63-158)

Explorer XII measurements of the intensity of interplanetary protons of energy greater than 3 Mev provide a method of investigating long-lived solar plasma streams. On two occasions an increase of the intensity of plasma streams were observed. The increases were unaccompanied by a solar flare but occurred at the beginning of a magnetic storm and Forbush decrease near the time of central meridian passage of a region responsible for a flare and a solar proton event during the previous solar rotation. P.V.E.

N64-23990* Maryland U., College Park.
DISTRIBUTION OF DENSITY IN AN ION-EXOSPHERE OF A NON-ROTATING PLANET Technical Report No. 355
Aharon Eviator, Allen M. Lencher, and S. Fred Singer Feb. 1964 19 p
(Grants NsG-58-60; WBG-4-62) OTS: $1.60 ph

A model of an ion exosphere is set up, and an expression is derived for the variation of density with altitude. The ions are considered to be under the control of superimposed gravitational and static, centered-dipole magnetic fields, and to have mirror points in the barosphere. Collisions are ignored, and the particles are assumed to be trapped in the dipole field. By use of the first adiabatic invariant and Liouville's theorem, the density is found to fall off faster with height in the exomagnetosphere than in either a neutral exosphere or an ionized barosphere. A justification of the use of reduced effective gravity for the scale height of the ions is given. Author

N64-24083* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC-RAY HYDROGEN AND HELIUM NUCLEI DURING A SOLAR QUIET TIME IN JULY 1961
C. E. Fichtel, D. E. Guss, G. R. Stevenson, and C. J. Waddington (Bristol U.) Repr. from the Phys. Rev., v. 133, no. 3B, 10 Feb. 1964 p B818–B827 refs
(NASA-RP-203)

This paper discusses the determination of the energy spectra of low-energy primary cosmic-ray hydrogen and helium nuclei from nuclear emulsions flown on a high-altitude balloon launched from Fort Churchill on July 8, 1961. The flight was preceded by a period of three months of low solar and geophysical activity. The results indicate that the differential spectrum of hydrogen nuclei in this low-energy interval decreased toward low energies and did not exhibit the sharp rise found with counters in 1960 and 1961 by other experimenters. The low-energy differential spectrum and integral flux value for helium nuclei were found to be intermediate between those typical of solar minimum and solar maximum and are consistent with a modulation mechanism that yields the same rigidity spectrum for a given intensity both before and after solar maximum. Various modulation models of galactic cosmic rays are examined, and it is concluded that none of them is entirely adequate. IAA

N64-24140 Library of Congress, Washington, D.C. Aerospace Information Div.
FORCASTING SOLAR FLARES: A REVIEW OF THE WORK OF A. B. SEVERNYY IN THE PERIOD 1960–1962 Selected Abstracts
28 Mar. 1963 25 p
(AID-P-63-43) OTS: $2.60 ph

The abstracts presented in this preliminary report are considered to be indicative of the development of solar flare investigations at the Crimean Astrophysical Observatory. A new method of forecasting solar flares two to three days in advance was proposed by A. B. Severnyy. The abstracts cover Severnyy's method and a serious objection to it. An attempt is made to evaluate the Severnyy method. Individual Soviet-bloc (Rumanian, Polish, Czech, and Ukrainian) works on solar flare research have also been included when deemed significant. Author

29 SPACE SCIENCES

Includes space chemistry; cosmology; lunar and planetary exploration; and theoretical analysis of orbits and trajectories. *For space biology see*: 16 Life Sciences. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 22 Navigation and Guidance.

N64-22778* Wisconsin U., Madison Geophysical and Polar Res. Center

MICROSCOPIC EXTRATERRESTRIAL PARTICLES FROM THE ANTARCTIC PENINSULA

Richard A. Schmidt (NASA. Ames Res. Center) [1963] 29 p refs Presented at the Cosmic Dust Conf., N.Y., 21–22 Nov. 1963

(Supported by NSF)

(NASA-TM-X-51131) OTS: $2.60 ph

While several types of particles were recognized, black, metallic spherules and yellowish, glassy spherules were most common. The metallic spherules ranged from 10 to 170 microns in diameter, had physical properties generally similar to magnetite, and were rich in iron. The glassy spherules ranged from 10 to 300 microns in diameter, had physical properties similar to various forms of silica glass, and were rich in silica. A few glassy spherules appeared to be akin to tektites. Direct relations of frequency of spherule occurrence and annual snow deposit were suggested by the data, while an inverse relation between snow accumulation and mean spherule size was discovered. Exceptions to these relations were attributable to local and regional topographical and meteorological effects. The cumulative rate of deposition of metallic spherules was found to be essentially uniform for the area of the Antarctic Peninsula Traverse, although at individual stations the rates were divergent because of local factors. Author

N64-23052* National Aeronautics and Space Administration. Washington, D.C.

SURVEYS OF THE OXYGEN MULTIPLETS λ 7774 AND λ 8446 IN THE SOLAR CHROMOSPHERE [NABLYUDENIYA KISLORODNYKH MUL'TIPLETON λ 7774 I λ 8446 V SOLNECHNOY KHROMOSFERE]

G. M. Nikol'skiy Jun. 1964 8 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya, v. 4, no. 2, 1964 p 209–212

(NASA-TT-F-9000)

By means of a new nonecliptic coronograph (Lyot coronograph), a considerable quantity of chromospheric spectrograms in various weak and bright emission lines was obtained in the summer of 1963. Particular attention was paid to oxygen lines. Author

N64-23122* National Aeronautics and Space Administration, Washington, D.C.

PRELIMINARY RESULTS CONCERNING THE INVESTIGATION OF METEOR MATERIAL ALONG THE FLIGHT TRAJECTORY OF THE "MARS-I" SPACE PROBE [PREDVARITEL'NYYE REZUL'TATY ISSLEDOVANIYA METEORNOGO VESHCHESTVA VDOL' TRAYEKTORII POLETA MEZHPLANETNOY STANTSII "MARS-I"]

T. N. Nazarova, A. K. Bektabegov, and O. D. Komissarov Nov. 1963 5 p Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 1, Jul.–Aug. 1963 p 169–171

(NASA-TT-F-8570)

Investigation of meteor material was carried out on the Mars I space probe by means of piezoelectric sensors. The area exposed to the impact of meteor particles comprised 1.5m^2. The space probe intercepted a Taurid meteor stream; this meteor material was analyzed, and preliminary results are discussed. G.D.B.

N64-23124* National Aeronautics and Space Administration, Washington, D.C.

LIGHT SCATTERING IN THE SPHERICAL ATMOSPHERE. II [RASSEYANIYE SVETA V SFERICHESKOY ATMOSFERE. II]

I. N. Minin and V. V. Sobolev Feb. 1964 14 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 2, 1963 p 227–234

(NASA-TT-F-8814)

An investigation into light scattering in the planetary atmosphere, with allowance for atmospheric-layer curvature, is continued. The case is considered in which the atmospheric coefficient of absorption is constant. An analytical solution for the fundamental equation determining J is obtained. Taken into account was the reflection of light from the planet's surface. Formulas are given for the intensity of the radiation leaving the atmosphere. The solution can be applied to the case of illumination of a homogeneous sphere. Considered in detail was the formula determining the intensity of radiation leaving a homogeneous sphere after single scattering. From this formula, asymptotic formulas were obtained for large-sphere optical radii. N.E.A.

N64-23177 Joint Publications Research Service, Washington, D.C.

PROBLEMS OF COSMOGONY. VOLUME IV

29 May 1964 305 p refs Transl. into ENGLISH of Vopr. Kosmogonii (USSR), v. IV, 1955 p 1–30

(JPRS-24851; OTS-64-31375) OTS: $5.00

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3. LUMINESCENCE OF GASEOUS NEBULAE A. Ya. Kipper p 45–72 refs (See N64-23180 16-29)
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6. SCATTERED GROUPS OF SUPERGIANTS B. A. Vorontsov-Vel'yaminov p 105–120 refs (See N64-23183 16-29)

N64-23178 Joint Publications Research Service, Washington, D.C.

ANGULAR MOMENTUM OF THE SUN

N. N. Pariyskiy *In its* Probl. of Cosmogony 29 May 1964 p 1–32 refs (See N64-23177 16-29) OTS: $5.00

This article considers the possibility of the internal layers of the sun having a greater angular momentum, during rotation, and a greater angular velocity than the surface layers. The calculations presented have the nature of an approximate evaluation of the possible maximum angular momentum. Observed data are used with respect to the contraction of the surface layers, which contraction is assumed to be less than 10^{-4}. Several models are considered for the structure of the sun. For the model closest to dynamic equilibrium, the maximum allowable angular momentum is found to be 4.3 times greater than the Schwartzschild model—a model rotating as a solid body. It is indicated that the angular momentum of the sun is only 2% of the total angular momentum of all of the planets of the solar system. I.v.L.

N64-23179 Joint Publications Research Service, Washington, D.C.

THE INFRARED SPECTRUM OF COMETS

S. M. Poloskov *In its* Probl. of Cosmogony 29 May 1964 p 33–44 refs (See N64-23177 16-29) OTS: $5.00

The present state of the problem of infrared radiation of comets is investigated. Data are presented for the infrared spectrum of the comets, and the possibility of identifying the observed intensity of radiation at λ7906 and λ8106 as bands of monoatomic and diatomic neutral molecules is discussed. It is shown that it is impossible to satisfactorily identify the observed radiation as monoatomic molecules of NH_3, HCN, etc., which may be expected to be absent in comets. Considerations are presented in support of the fact that infrared radiation of comets may be satisfactorily identified with a new system ($^2\Pi$–$^2\Sigma$) of the N_2 molecule. I.v.L.

N64-23180 Joint Publications Research Service, Washington, D.C.
LUMINESCENCE OF GASEOUS NEBULAE
A. Ya. Kipper *In its* Probl. of Cosmogony 29 May 1964 p 45–72 refs (See N64-23177 16-29) OTS: $5.00

A description is presented of several processes of radiation and absorption of light in planetary and in diffuse gaseous nebulae. Emphasis is placed on: (1) the probability of transition among the states of an atom; (2) basic mechanisms of the radiation of planetary nebulae; and (3) the origin of the continuous spectral background of gaseous nebulae. I.v.L.

N64-23181 Joint Publications Research Service, Washington, D.C.
THE NATURE OF COMET-SHAPED NEBULAE
V. A. Ambartsumyan *In its* Probl. of Cosmogony 29 May 1964 p 73–83 refs (See N64-23177 16-29) OTS: $5.00

This report describes efforts expended in the establishment of the relationship between comet-shaped nebulae and comet-shaped inclusions in diffused nebulae. I.v.L.

N64-23182 Joint Publications Research Service, Washington, D.C.
LIGHT PRESSURE ON THE DUST AND GAS IN THE ENVIRONMENT OF STARS OF DIFFERENT TYPES
V. S. Safronov *In its* Probl. of Cosmogony 29 May 1964 p 84–104 refs (See N64-23177 16-29) OTS: $5.00

Results of investigations indicate that the radiation pressure of hot stars is a powerful source of motion of interstellar substances and influences the structure and evolution of nebulae. I.v.L.

N64-23183 Joint Publications Research Service, Washington, D.C.
SCATTERED GROUPS OF SUPERGIANTS
B. A. Yorontsov-Vel'yaminov *In its* Probl. of Cosmogony 29 May 1964 p 105–120 refs (See N64-23177 16-29) OTS: $5.00

Various properties of stellar clouds and stellar masses are investigated, and the problems of the possible existence of small groups of scattered stars, consisting of single supergiants, are analyzed along with the possibility of the origin of such stars. These groups are not similar to the usual stellar masses or to the multiple stars and do not come under the definition of O-associations. It is most probable that these groups are the remains of scattered stellar masses. I.v.L.

N64-23216 Boeing Scientific Research Labs., Seattle, Wash. Geo-Astrophysics Lab.
RADIATIVE TRANSPORT OF HEAT IN LUNAR AND PLANETARY INTERIORS
Zdenek Kopal (Manchester U.) Feb. 1964 89 p refs
(D1-82-0328)

The aim of the present investigation was to formulate and solve the problem of the radiative transfer of energy in solid globes of planetary size—both in their interiors as well as surface layers—with the radiative loss into space taken into account. The time-dependent partial differential equation of radiative transfer was formulated in terms of spherical polar coordinates, and a method developed to construct a solution of this equation, to an arbitrary order of accuracy, both for the emissivity or temperature as the dependent variable. In the latter case, the well-known equation of heat conduction is obtained as a limiting case if the mean free path of the energy-carrying photons tends to zero. The problem of the radiative transfer of energy in planetary interiors, with radiative loss at the boundary, is solved analytically for the case of a homogeneous globe characterized by constant absorption coefficient. A suitable substitution can render the problem linear if the emissivity—rather than temperature—is adopted as the dependent variable, and solvable in terms of Fourier series arising by the invasion of a certain finite Fourier sine transform of the emissivity. The same technique is applied to the solution of a plane-parallel problem of radiative energy transfer in surface layers subject to a periodic insolation from above. Author

N64-23305 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEW PHASE IN INVESTIGATING THE COSMOS
L. Sedov 23 Jul. 1963 7 p Transl. into ENGLISH from Pravda (Moscow), no. 229, 17 Aug. 1962 p 2
(FTD-TT-63-676/1; AD-417410)

This is a general review of Soviet successes in satellite launchings and in space flight, with particular attention paid to the simultaneous flights of Nikolayev and Popovich. E.K.R.

N64-23311 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE WAY TO THE COSMOS
V. Dubronravov 3 Jan. 1964 14 p Transl. into ENGLISH from Kryl'ya Rodiny (USSR), no. 6, 1957 p 20–22
(FTD-TT-63-975/1+2; AD-430239)

The possibilities of launching, for scientific purposes, the first man-made Earth satellites are discussed. A design for flying an orbital cosmic station is given. The station is designed to provide refueling for manned space rockets. Some of the problems that will be encountered in space flight, such as weightlessness and radiation hazards, are discussed. R.T.K.

N64-23430 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PHOTO FROM THE COSMOS
V. A. Sokolov 9 Oct. 1963 10 p Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 3, 1960 p 8–10
(FTD-TT-962/1+2; AD-423207)

A brief discussion is presented of the means by which the far side of the moon was photographed and the pictures were transmitted to earth. P.V.E.

N64-23526* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE INTERIOR OF THE MOON
Stanley Keith Runcorn 15 Dec. 1963 15 p refs
(Contract NAS7-100)
(NASA-CR-56510; JPL-TR-32-529) OTS: $1.60 ph

The differences in the moments of inertia of the moon and its ellipticity toward the earth are between 15 and 40

times those calculated on a hydrostatic theory. Of possible explanations, the most satisfactory explanation is that convection, described by second-degree harmonics, is occurring. Second-order convection implies the existence of a small core, presumably iron, and results in a new discussion of the moon's evolution and thermal history. Author

N64-23528* Bell and Howell Research Center, Pasadena, Calif.
STUDY DIRECTED TOWARD SELECTION OF APPARATUS FOR ANALYSIS OF LUNAR CRUST AND ATMOSPHERE Summary Report
Wilson M. Brubaker Oct. 1963 32 p refs
(Contract NAS8-11013)
(NASA-CR-56545) OTS: $3.60 ph

This study is directed toward the instrumentation problems associated with the analysis of the lunar crust and atmosphere by mass spectrometry. Based on a survey of the present knowledge and theories of the lunar characteristics, a major portion of this study is concerned with the type of mass analyzer that holds the greatest potentialities for this specific application. The lunar environment has been considered, with emphasis being given to its influence on the instrumentation package. The characteristics of various types of ionic mass analyzers have been reviewed, and their potentialities for use in the lunar environment are discussed. The desired improvements in the state-of-the-art in the field of mass spectrometry are considered. N.E.A.

N64-23640 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FLIGHT TO MARS IS BECOMING A REALITY
L. I. Sedov *In its* Stations in Space 10 Feb. 1964 p 28–32 (See N64-23634 16-01)

The paper deals with two problems—reentry after planetary flight and the possibility of life on Mars. Lunar landings are discussed briefly, and a plea is made for world peace through world exploration of space. A.W.

N65-23642 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FROM THE EARTH TO THE MOON
A. G. Masevich *In its* Stations in Space 10 Feb. 1964 p 38–41 (See N64-23634 16-01)

The Soviet Union claims a direct hit on the moon and pays tribute to those it considers responsible for the achievement. A.W.

N64-23643 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FROM MOON TO EARTH
P. I. Yevdokimov *In its* Stations in Space 10 Feb. 1964 p 42–46 (See N64-23634 16-01)

The report deals with space telemetry. Telemetric systems can be divided into two parts; the apparatus carried aboard the rocket, and the equipment at ground stations. One of the scientific instruments aboard a rocket is described—the counter used for studying the intensity of cosmic radiation. The ground telemetry converts data received from instruments aboard the rocket into comprehensible form. Recording of data is either by registry of magnetic tape or by photograph. The possibility of flights to Mars and Venus requires the development of telemetry capable of transmitting data during many months of flight over distances of hundreds of millions of kilometers. A.W.

N64-23644 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FIRST FLIGHT TO THE MOON
In its Stations in Space 10 Feb. 1964 p 47–56 (See N64-23634 16-01)

The paper presents a detailed account of the motion of the moon and certain problems associated with the selection of the flight trajectory in the Soviet attempt to reach the moon. A.W.

N64-23852 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COSMIC RESEARCH, VOLUME 2, NUMBER 1
27 Apr. 1964 294 p refs Transl. into ENGLISH of Kosmich. Issled. (Moscow), v. 2, no. 1, 1964 p 3–174
(FTD-TT-64-499/1+2+4; AD-439330)

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7. RADIO EMISSION FROM SHOCK WAVES AT THE EARTH AND IN INTERPLANETARY GAS M. A. Gintsburg p 96–108 refs (See N64-23859 16-28)

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12. SOME RESULTS OF RADIOMETRIC MEASUREMENTS AT ALTITUDES OF 200–400 KM FROM 1960–1963 S. N. Vernov, I. A. Savenko, P. I. Shavrin, V. Ye. Nesterov, N. F. Pisarenko et al p 216–235 refs (See N64-23864 16-12)

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14. MEASURING SOFT RADIATION IN THE EQUATORIAL LATITUDES ON COSMOS-4 I. A. Savenko, P. I. Shavrin, N. F. Pisarenko, V. Ye. Nesterov, M. V. Tel'tsov et al p 240–247 refs (See N64-23866 16-28)

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N64-23853 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

INTERMEDIATE ORBITS OF ARTIFICIAL EARTH SATELLITES

E. P. Askenov *In its* Cosmic Res. 27 Apr. 1964 p 1–17 refs (See N64-23852 16-29)

Expressions are derived for the coordinates of a satellite in the form of elliptic functions of a certain intermediate variable, and the relation between this variable and time is established. The expansions for conic coordinates into trigonometric series are found, which converge for all moments of time. These expansions are valid for any values of the orbital eccentricity. All terms whose amplitudes are not less than 10^{-8} are preserved. Author

N64-23854 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

INTERMEDIATE ORBITS OF ARTIFICIAL EARTH SATELLITES WITH A SMALL ECCENTRICITY

Ye. P. Askenov *In its* Cosmic Res. 27 Apr. 1964 p 18–29 refs (See N64-23852 16-29)

This paper examines the intermediate orbits of artificial earth satellites whose eccentricities do not exceed approximately 0.2. The intermediate orbits are constructed taking into account the terms of the first and, partially, of the second order of smallness of the potential of the earth's gravitation (only the so-called normal gravitational field is taken into account). The paper establishes a relation, which is similar to the center equation in the theory of Keplerian motion, between some intermediate variable through which the coordinates of the satellite are expressed and time. The relation for arbitrary eccentricities is somewhat cumbersome. Author

N64-23857 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

VARIATIONAL PROBLEM CONCERNING FLIGHT BETWEEN HELIOCENTRIC CIRCULAR ORBITS USING SOLAR SAILS

A. N. Zhukov and V. N. Lebedev *In its* Cosmic Res. 27 Apr. 1964 p 67–73 refs (See N64-23852 16-29)

This article considers the problem of finding optimum (in the sense of high-speed) guidance for flights from the orbit of the earth to orbits of other planets in the solar system. Sail orientation with respect to solar rays is the guidance parameter. It is assumed that planet orbits are circular and coplanar. The resistance of the cosmic medium is considered to be small in comparison with solar pressure. This problem, with the aid of the maximum principle of L. S. Pontryagin, leads to a boundary-value problem for a system of eight differential equations solved on an electronic computer, the selection of missing initial conditions being made by the Newtonian method. The article concludes that, by using solar sails, it is possible to fly, without the expenditure of fuel, from the orbit of an artificial earth satellite to the orbit of an artificial satellite of another planet in the solar system since the launching of a space ship by means of a solar sail within the gravitational field of a planet also proves to be feasible. Author

N64-23895* Geophysics Corp. of America, Bedford, Mass.

THE EFFECT OF CLOUDINESS ON A GREENHOUSE MODEL OF THE VENUS ATMOSPHERE

George Ohring and Joseph Mariano Repr. from J. of Geophys. Res., v. 69, no. 1, 1 Jan. 1964 12 p refs

(Contract NASw-704)

In previous models of the greenhouse effect in the Venus atmosphere, it was assumed that infrared-absorbing atmospheric gases provide the sole contribution to the infrared opacity of the Venus atmosphere. In the present study, the influence of an extensive cloud cover, opaque to infrared radiation, is also included in the greenhouse model. The magnitude of the greenhouse effect, which is defined here as the ratio of the surface temperature produced by the greenhouse to the surface temperature of an atmosphereless Venus, is computed as a function of infrared opacity of the atmosphere, and amount and height (actually ratio of cloud-top pressure to surface pressure) of clouds. It is assumed that the Venus atmosphere is gray, that the absorbing gas has a constant mixing ratio, and that the temperature variation with altitude in linear. Calculations are made for two temperature lapse rates: the adiabatic lapse rate and nine-tenths of the adiabatic lapse rate. The adiabatic lapse rate maximizes the greenhouse effect; for this case estimates of the minimum infrared opacity required to maintain the observed surface temperature can be determined. For a surface temperature of 700° K, 99% cloudiness, and cloud-top temperature of 240° K, the minimum required infrared opacity is 6. Uncertainties and questionable side effects of the model are discussed. The model is quite general and can be applied to other planetary atmospheres; sample calculations are shown for the Earth and Mars. Author

N64-23950* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

JPL EPHEMERIS TAPES E9510, E9511, AND E9512

P. R. Peabody, J. F. Scott, and E. G. Orozco 2 Mar. 1964 124 p refs

(Contract NAS7-100)

(NASA-CR-56285; JPL-TM-33-167) OTS: $10.10 ph

These tapes carry the positions and velocities of the planets and of the moon, plus nutations and nutation rates in longitude and obliquity, together with second and fourth modified differences, for the interval December 30, 1949, to January 5, 2000. Author

N64-23992* New Mexico State U., University Park, Research Center

A PHOTOGRAPHIC OPTICAL SEMIDIAMETER OF VENUS

Bradford A. Smith 5 Nov. 1963 14 p refs

(NASA Grant NsG-142-61)

(NASA-CR-56364; TN-557-64-4) OTS: $1.60

Measurements of the optical diameter of Venus are generally free from the usual systematic errors when such measurements are made of the illuminated crescent at phase angles approaching 180°. Fifty-four photographic images obtained within a few days of inferior conjunction in November 1962 have been measured across the diameter connecting the geometric cusps. An optical semidiameter of 8".486 ±0".004 (p.e.) at unit distance is found, and is in some disagreement with visual observations. A radius of 6,050 km for the solid globe of Venus and a resulting mean density of 5.25 g cm^{-3} is inferred. Author

N64-24023* General Mills, Inc., Minneapolis, Minn. Aerospace Research
INVESTIGATION OF SPUTTERING EFFECTS ON THE MOON'S SURFACE Fourth Quarterly Status Report, 25 Jan. 1963–24 Apr. 1964
G. K. Wehner, D. L. Rosenberg, and C. E. KenKnight 27 Apr. 1964 47 p refs
(Contract NASw-751)
(NASA-CR-56292; Rept.-2563) OTS: $4.60 ph

Additional hydrogen sputtering yields on metals and metal oxides were obtained, confirming earlier values for Al, Ti, and Fe and revealing that chemical effects double the sputtering rate on SiO_2 relative to Si, for which yields of $0.018/H_2^+$ and $0.046/H_3^+$ at 7.5 keV were obtained. Helium yields were determined using the same mass-analyzed ion beam hole-drilling technique as with hydrogen. Bombardment of powdered basalt by ions from He and He-H_2 mixture plasmas does not result in accelerated surface darkening or alteration. Surface darkening by hydrogen bombardment of a segment of the Holbrook meteorite were observed and measured. The normal albedo was reduced from 0.30 to 0.12 by the equivalent of 10^4 years of solar-wind bombardment. Reflection curves and normal albedos are given for various oxides and minerals before and after exposure to simulated solar-wind bombardment equivalent to periods of up to 2×10^5 years. Author

N64-24038* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
MEASUREMENTS OF PLANETARY ELECTRIC CURRENTS
S. K. Runcorn Apr. 1964 5 p refs Repr. from Nature, v. 202, no. 4927, Apr. 1964 p 10–13
(Contract NAS7-100)
(NASA-CR-56447; JPL-TR-32-608)

Measurements of earth currents made on the Suva-Auckland cable during May 16 to May 19, 1963 and on the Sydney-Auckland cable during May 16 to May 19, 1963 are graphically represented. The graphs show that, on magnetically quiet days, the main currents arise from the ocean tides. I.v.L.

N64-24039* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
AN EVALUATION OF THE COMMUNICATION BLACKOUT PROBLEM FOR A BLUNT MARS-ENTRY CAPSULE AND A POTENTIAL METHOD FOR THE ELIMINATION OF BLACKOUT
Dwain F. Spencer 15 Apr. 1964 27 p refs
(Contract NAS7-100)
(NASA-CR-56459; JPL-TR-32-594) OTS: $2.60 ph

Unless preventive methods are used, it appears that the communications link from a blunt body entering the Martian atmosphere will be blacked out during entry because of the free electron concentration in the wake of the capsule. Estimates of the free electron concentration in the wake indicate peak values of approximately 3×10^{12} electrons/cm^3, whereas the critical electron concentration for S-band transmission at 2.295 mc is 10^{11} electrons/cm^3. The injection of a high-electron-affinity fluid such as carbon tetrachloride may reduce the free electron concentration below this critical value. The amount of fluid required is estimated to be 1 to 10 lb. The latter statement must be experimentally confirmed, however, before the use of an auxiliary fluid-injection system can be fully evaluated. Author

N64-24042* Meteorology Research, Inc., Altadena, Calif.
A MOISTURE ANALYZER FOR MARTIAN ATMOSPHERE Final Report
Paul B. Mac Cready, Jr. 10 Sep. 1962 81 p
(Contract NAS7-100; JPL-950207)
(NASA-CR-56454; MRI62-FR-48) OTS: $8.10 ph

A 4-month study and experimental program was undertaken to determine if the phosphorous pentoxide type of moisture meter could be used to measure the expected water vapor in the Martian atmosphere while being lowered to the surface in an instrument package ejected from a space vehicle near this planet. An operating breadboard model of the proposed system met or exceeded most of the criteria set forth for this project. For the system designed, temperature and sterilization requirements do not appear to impose any severe problems. The space and weight requirement of 1lb and 500 cc were surpassed, the model weighing approximately 11 ounces, with a volume of approximately 450 cc. The overall maximum power requirement of 500 mw can be met, but there would be some advantages if more power were available. The present moisture sensor and system is believed to be capable of operation down to levels of 0.5 ppm. Author

N64-24053* American Mathematical Society, New York, N.Y.
LECTURE NOTES PREPARED IN CONNECTION WITH THE SUMMER SEMINAR ON SPACE MATHEMATICS HELD AT CORNELL UNIVERSITY, ITHACA, NEW YORK, PART II
W. H. Guier et al [1963] 277 p refs Seminar held 1 Jul.–9 Aug. 1963
(Grants NsG-358; AF-AFOSR-258-63; Contracts DA-31-124-ARO(D)-82; AT(30-1)-3164; Nonr(G)-00025-63 et al)
(NASA-CR-56201) OTS: $17.50

The following topics are discussed: (1) methods for specifying the motion of a tracking station in inertial space, given the usual geodetic measurements available for a point on the earth's surface; (2) the motion of a near-earth satellite when influenced by the various harmonics of the earth's gravity field (geopotential); and (3) the functional dependence of various types of tracking data upon the trajectories of the station and the satellite in inertial space. I.v.L.

N64-24056 Bendix Corp., Ann Arbor, Mich. Bendix Systems Div.
SIMULATED EXTRUSIVE MAGMA SOLIDIFICATION IT VACUUM
Walter I. Dobar, John P. Gnaedinger, and O. Lyle Tiffany Mar. 1964 25 p refs

The upwelling and solidification of a simulated magma in vacuum has produced a porous material (suggested name: "Simolivac") not found in nature. Bearing-strength measurements show that this material can accommodate static loads up to 4 tons/sq ft. Samples of Simolivac were irradiated with a cobalt 60 source, and photometric curves were obtained of nonirradiated and irradiated samples. Good correlation is shown between the photometric curves of Simolivac and the lunar surface. Author

N64-24075* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THEORY OF TUMBLING BODIES ENTERING PLANETARY ATMOSPHERES WITH APPLICATION TO PROBE VEHICLES AND THE AUSTRALIAN TEKTITES
Murray Tobak and Victor L. Peterson Washington, NASA Jul. 1964 39 p refs
(NASA-TR-R-203) OTS: $1.00

The tumbling motion of aerodynamically stable bodies entering planetary atmospheres is analyzed considering that the tumbling, its arrest, and the subsequent oscillatory motion are governed by the equation for the fifth Painlevé transcendent. Results based on the asymptotic behavior of the transcendent are applied to study the oscillatory behavior of planetary probe vehicles in relation to aerodynamic heating and loads and the dynamic behavior of the Australian tektites on entering the earth's atmosphere, under the hypothesis that their origin was the moon. Author

N64-24113* Ohio State U. Research Foundation, Columbus Antenna Lab.
NORMALIZATION OF BISTATIC RADAR RETURN
Donald E. Barrick 15 Jan. 1964 18 p
(Grant NsG-213-61)
(NASA-CR-56310; Rept.-1388-13) OTS: $1.60 ph

Theoretically, the scattering cross-section per unit area of an arbitrary surface can be determined by measurement of the power received, as long as an integration of the incident power density over the surface illuminated can be performed. The class of surfaces considered have an average height that is planar, and the antennas are highly directional and equidistantly placed at various incidence and scattering angles above the surface. The integration is performed for various values of incidence and scattering using the digital computer, and tables of this normalized integral are presented. These tables may then be used to determine the approximate bistatic scattering cross section for such a surface from measurements of the scattered power. Author

N64-24132 American Bosch Arma Corp., Garden City, N.Y. ARMA Div.
ON A STUDY OF SPECIFIC METHODS OF MEASURING LUNAR GRAVITY Final Report
Harold Levenstein, Paul H. Savet, Murray J. Stateman, and Frank Wessbecher Apr. 1964 66 p refs
(Contract AF 19(628)-3855)
(DS-64-R531-35; AFCRL-64-363; AD-601824)

The measurement of the gravity field of the moon from an orbiting satellite is examined from the points of view of requirements for geodetic and geophysical application, and physical phenomena and instrumentation to meet these requirements. It is feasible to determine the gravity field by measuring the gravity gradient. Mathematical relations useful for data processing are stated. Examination of several principles for sensing gravity gradient leads to the recommendation of the vibrating string gradiometer as the best implementation with size, accuracy, range, and versatility being in its favor. In addition, the engineering status allows prototype design to begin immediately. Author

N64-24158* Consultants and Designers, Inc., Arlington, Va.
HELIUM AND ATOMIC HYDROGEN IN A PERIOD OF SOLAR ACTIVITY MINIMUM [L'HELIUM ET L'HYDROGEN ATOMIQUE AU COURS D'UN MINIMUM D'ACTIVITE SOLAIRE]
G. Kockarts and M. Nicolet Sept. 1963 47 p refs Transl. into ENGLISH from a Paper Presented at the 4th COSPAR Space Sci. Symp., Warsaw, Jun. 1963 Submitted For Publication
(Contract NAS5-2078)
(NASA-TT-F-8625; ST-AA-10045)

The vertical distribution of helium and of atomic hydrogen has been determined for the case of minimum solar activity corresponding to temperatures reaching 850° K in daytime and lowering to about 650° K in nighttime. The effect of thermal diffusion in the thermosphere plays an important part in the concentration of helium and hydrogen. Moreover, the vertical distribution of hydrogen is deeply influenced by the decrease of the thermopause temperature beginning at 1,000° K. Finally, the effect of the altitude that is chosen for the thermopause level has been determined. The choice of altitude is important when the temperature of the thermopause is less than 750° K. The physical conditions beyond 500 km have been determined for periods of solar quiet so as to establish the behavior of atomic hydrogen, helium, and atomic oxygen. The liberation of atomic hydrogen is influenced when the thermopause temperature is less than 850°, whereas that of He^4 and He^3 depend simultaneously on the thermal and ionization effects. Author

N64-24163* American Mathematical Society, New York, N.Y.
LECTURE NOTES PREPARED IN CONNECTION WITH THE SUMMER SEMINAR ON SPACE MATHEMATICS HELD AT CORNELL UNIVERSITY, ITHACA, NEW YORK, PART I
[1963] 148 p refs Seminar held Jul. 1–Aug. 9, 1963
(Grants NsG-358; NSF GE-2234; AF-AFOSR 258-63)
(NASA-CR-56202) OTS: $11.00 ph

This report presents discussion of the following topics: (1) a summary of the Copenhagen problem; (2) an introduction to dynamic programing; (3) the calculus of variations—computational aspects; (4) dynamic programing and stochastic control processes; (5) feedback control theory, stochastic control theory, and adaptive processes; (6) adaptive control; (7) elliptic motion; and (8) matrix methods. I.v.L.

N64-24175 Liege U. (Belgium)
RESEARCH ON RELATIONS BETWEEN COMETARY, SOLAR AND UPPER ATMOSPHERIC PROCESSES Annual Summary Report, 1 Apr. 1963–31 Mar. 1964
P. Swings et al 31 Mar. 1964 23 p refs
(Contract AF 61(052)-587)
(AFCRL-64-393; ASR-2; AD-601136)

Laboratory work has covered the following: the time resolution of spectra; the spectra of several molecules of astronomical interest; various instruments; and the study of photomultipliers. The physical mechanisms in comets are discussed. Other programs of cometary investigations have been started. Investigations related to space experiments are mainly concerned with the far ultraviolet spectra of stars, comets, and aurorae, and with artificial comets. Author

N64-24205 Manchester U. (Gt. Brit.)
DEVELOPMENT OF THE LUNAR TOPOGRAPHY INTO SPHERICAL HARMONICS, II Technical Note No. 2
C. L. Goudas Feb. 1964 60 p refs
(Contract AF 61(052)-524)
(AFCRL-64-428; AD-601137)

On the basis of absolute height measures on the surface of the moon made previously, the lunar figure was analyzed into spherical harmonics, including terms of up to the eighth order. In doing so, it was postulated that the two sides of the moon were symmetrical. Two sets of values were determined for the coefficients of the harmonic expansion based on Schrutka's and Baldwin's sets of points. The results agree with the theoretical conclusion based on a hydrostatic stress and uniform density assumption, that the second surface harmonic of the moon is small. Author

30 SPACE VEHICLES

Includes launch vehicle-spacecraft combinations; missile systems; operating problems; safety devices; and stability and control. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-22747* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ACOUSTIC EFFICIENCY TRENDS FOR HIGH THRUST BOOSTERS
S. H. Guest Washington, NASA, Jul. 1964 13 p refs
(NASA-TN-D-1999) OTS: $0.50

The acoustic efficiency indicative of the generated acoustic power of a system was computed from measured far-field acoustic data to establish a general trend in production of acoustic power from the turbulent exhaust flow of a rocket as the mechanical power or thrust increases. The significance and limitations of presently adopted acoustic efficiencies are discussed, with a presentation of these computed efficiency values versus mechanical power. A more adequate method to define the true acoustic efficiency is briefly described for static sound sources. Author

N64-22904 Bendix Corp., Ann Arbor, Mich. Bendix Systems Div.
THE CANADIAN ARMAMENT RESEARCH AND DEVELOPMENT ESTABLISHMENT (CARDE) SUPPORT PROGRAM Semiannual Report, 1 Jan.–30 Jun. 1963
[1963] 31 p
(Contract DA-20-018-ORD-23307; ARPA Order 133; Proj. Defender)
(BSC-39259; AD-436437)

Reentry physics research by the Canadian government is discussed. Included are hypervelocity studies, radiation physics, Doppler radar, and impact and penetration. New instrumentation developed comprised major range, oscilloscope photograph reader, and telemetry. Four aspects of the microwave program are described, as well as fragment impact effects, radiation, nose-afterbody drag separation, and range Q-coil. G.D.B.

N64-23156 Douglas Aircraft Co., Inc., Santa Monica, Calif. Missiles and Space Systems Div.
THE DYNAMIC ENVIRONMENT OF THE S-IV STAGE DURING TRANSPORTATION
R. W. Trudell and K. E. Elliott *In* Defense Dept. Shock, Vibation and Assoc. Environments, Pt. 4 Mar. 1964 p 111–125 (See N64-23151 16-01)

This paper presents a detailed discussion of shock and vibration measurements obtained on the S-IV stage during transport on a soft tire land transporter, a hard tire land transporter, a seagoing freighter, a seagoing barge, and a modified B-377 aircraft (Pregnant Guppy). The primary emphasis is on the aircraft mode of transportation. The vibration levels measured on vehicle components and structure are compared with levels measured during individual component qualification tests, and with design criteria. Levels measured on the various carriers listed above are also discussed. Test limitations, instrumentation, and data-processing techniques are outlined. The acceptability of shock and vibration environments produced by each of the transportation modes listed above is established for the S-IV stage. Author

N64-23220 Space Technology Labs., Inc., Los Angeles, Calif.
ATLAS F. FINAL RELIABILITY SUMMARY REPORT FOR OSTF-2. VOLUME 3: APPENDICES
T. M. Lough et al 15 Nov. 1963 539 p refs
(Contract AF 04(694)-3)
(Rept.-6301-6596-RU-000; BSD/TDR-64-8; AD-436805)

The following appendices are included: (1) functional description of reliability blocks; (2) mathematical techniques; (3) associate contractor's part numbers versus reliability functional block numbers; (4) failure reporting system; and (5) proposal for an operational reliability instrumentation system. R.T.K.

N64-23228* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SITE BENCH MAINTENANCE TEST SET
John H. Johnson N.Y., AIAA [1964] 6 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-331) AIAA: $0.50 members, $1.00 nonmembers

SITE is a general-purpose test set flexible enough in its interfaces to accommodate all manned-spacecraft instrumentation systems. It is also flexible enough to accommodate spacecraft design changes. The equipment can test all present instrumentation and can easily be made to support future systems because it is modular and uses off-the-shelf items as building blocks. It is briefly described in this report. G.D.B.

N64-23283 Sandia Corp., Albuquerque, N. Mex.
RE-ENTRY FLIGHT DEMONSTRATION NUMBER ONE (RFD-1): DESIGN, DEVELOPMENT, AND PERFORMANCE OF THE RE-ENTRY VEHICLE
C. E. Erickson, H. C. Hardee, J. I. Hegge, J. Jacobs, S. L. Jeffers et al May 1964 155 p refs
(Sponsored By AEC)
(SC-RR-64-511) OTS: $2.75

The RFD-1 reentry system consisted of the SNAP-10A Simulated Test Reactor (SNAP-10A STR), the external fuel rod experiment, and the reentry vehicle (RV). The latter included the telemetry package and the vehicle assembly (with recovery system and Scout fourth-stage separation components). The SNAP-10A STR was instrumented to monitor transient temperature response as well as the sequence of reactor disassembly during reentry heating. The telemetry package transmitted the data obtained with this instrumentation and provided electrical functions for the reentry vehicle. The reentry vehicle itself served two purposes: (1) aerodynamically stable support for the SNAP-10A STR; and (2) housing for the telemetry package and the recovery system. The reentry vehicle was designed to survive reentry heating and to follow a predetermined trajectory after being carried into outer space on a four-stage Scout vehicle. The exterior fuel rods, which were ejected, contained flare material so that optical information on fuel-rod burnup could be obtained. The performance of the vehicle during the flight is discussed and compared with preflight predictions. Author

N64-23329* National Aeronautics and Space Administration, Washington, D.C.
NATIONAL ALTITUDE ROCKET TEST FACILITIES
Jack A. Suddreth Jun. 1964 12 p
(NASA-TM-X-969) OTS: $0.50

The necessity for experimental verification of rocket-engine performance at altitude or near-space conditions has long been recognized in the aerospace industry. Recent spacecraft rocket-engine research and development trends toward higher area ratios, advanced nozzle concepts, and nonequilibrium flow considerations have made altitude simulation a requirement of development programs. Because the need for information regarding the capabilities and characteristics of altitude test facilities that are suitable for liquid-rocket-engine operation was recognized, this survey was compiled with the help of representatives of industry and government agencies. Author

N64-23345 Lockheed Missiles and Space Co., Sunnyvale, Calif.
VEHICLE DATA LINK REQUIREMENTS: AN ANNOTATED BIBLIOGRAPHY
George R. Evans, comp. Aug. 1963 139 p refs
(SB-63-57; Rept.-5-57-63-3)

Primary interest of the search is centered on on-board instrumentation and on equipment for data such as telemetry, radio, and radar systems. Also of interest is ground equipment and systems; i.e., command and control, communications and tracking systems. Author

N64-23348* National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
SATURN I/IB PROJECT
Stanley Reinartz N.Y., AIAA [1964] 11 p Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.-2 Jul. 1964
(AIAA Paper-64-272) AIAA: $0.50 members, $1.00 nonmembers

This paper discusses the place of the Saturn I and IB Launch Vehicle within the overall space exploration plan. Presented briefly are the historical origin of the Saturn I and IB programs; the accomplishments of the Saturn I program; the plans for the balance of the Saturn I launches; the description, mission, and schedule of the Saturn IB hardware; and the potential uses of the Saturn IB launch vehicle beyond Apollo. N.E.A.

N64-23390 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONTROL OF REACTION-THRUST MISSILES
G. D. Krysenko 29 Aug. 1963 318 p refs Transl. into ENGLISH of the Book "Upravlenie Reaktivnymi Snaryadami" Moscow, Voennoe Izd. Min. Oborony SSSR, 1960
(FTD-TT-62-908/1+2; AD-422248)

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N64-23474 Grumman Aircraft Engineering Corp., Bethpage, N.Y. Engineering Dept.
SOME THOUGHTS AND OBSERVATIONS RESULTING FROM THE SPACE STATION SIMULATOR EXPERIMENTS
C. Wenzel and J. Lisa 18 Jun. 1964 15 p
(ADN-04-09-63.1)

This note presents arguments for a rotating space station and discusses how the simulator helps the investigator. Results from experiments conducted to date are presented in qualitative discussions that predict their effects on space station design. A comparison is made of what living in a rotating environment is like in space and in the simulator. A test configuration of 45° of tilt, a radius of 20 ft, and an RPM of 12 appears adequate to cover all necessary simulation. Author

N64-23518* Exotech Inc., Alexandria, Va.
INVESTIGATION OF A MICROMETEOROID VEHICLE DAMAGE ASSESSMENT SYSTEM
W. C. Cooley, P. G. Luckhardt, R. J. Janda, and P. E. Brockert Jun. 1963 61 p refs
(Contract NAS8-5033)
(NASA-CR-56562; TR-004) OTS: $6.60 ph

A laboratory calibration model of a meteoroid-puncture detection system has been developed, which can be used to measure the visible and infrared radiation produced by "puncture flash" in hypervelocity impact facilities. Research is reported on the infrared and visible radiation signals obtained from punctures of steel, Pyrex, and sapphire spheres through 50-mil aluminum in vacuum, air, helium, gaseous oxygen, and liquid oxygen. The nature of puncture flash phenomena is discussed, and conclusions are drawn as a result of correlation of the test data. Author

N64-23626* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
MOON OPERATIONS HERE ON EARTH
Donald E. Hewes and Amos A. Spady, Jr. Repr. from Astronautics and Aerospace Eng., Feb. 1964 p 24-28
(NASA-RP-207)

A technique is discussed for simulating a partial gravity for unlimited periods while allowing freedom of movement over considerable distances. A subject is supported by overhead cables so that he may walk on a very steep inclined plane. The support system is designed to minimize the effects of gravity on the subject so that he is almost weightless and experiences primarily the normal frictional forces associated with the wall. The plane may be tilted to simulate any gravity that is less than the earth's. Load carrying, vertical jumping, and climbing tests were conducted. The addition of light loads to the subject did not hamper his movements and actually proved to be an aid in walking. Under lunar gravity conditions, tests indicated that a man is capable of jumping up to 14 ft off the surface of the moon. Tests of stairs, ladders, and poles indicated that vertical ascent and descent were most easily achieved by employing the hands only. I.A.A.

N64-23645 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NONLIVING ASTRONAUT
B. S. Danilin *In its* Stations in Space 10 Feb. 1964 p 57–62 (See N64-23634 16-01)

The greatest danger to man in space flight is penetrating cosmic radiation. It is suggested that "an automatic pilot," which would not be harmed by radiation or any dangers facing man, be substituted for a living astronaut. The use of a "star compass," oriented on some distant star and constantly correcting the trajectory of the spaceship in accordance with the prescribed course, is also suggested. The nonliving astronaut would be equipped with telemetric sensors and would transmit data to receiving stations on the earth. The paper discusses the advantages of such an automatic pilot over man in space flight. A.W.

N64-23724 Goodyear Aerospace Corp., Akron, Ohio
EXPANDABLE DRAG DEVICES FOR MACH 10 FLIGHT REGIME
F. R. Nebiker *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 501–510 (See N64-23701 16-01)
(Sponsored by AF)

This report on expandable drag devices for a Mach-10 flight regime covers the following: performance and design studies, hypersonic wind-tunnel test, present aerodynamic deployable decelerators, and the application of the ballute deceleration system to the Gemini program. J.R.C.

N64-23725 Narmco Industries, Inc., San Diego, Calif.
AN ELASTIC RECOVERY CONCEPT FOR EXPANDABLE SPACE STRUCTURES
Bud L. Duft *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 511–534 (See N64-23701 16-01)

A program for the development and evaluation of the elastic recovery concept for expandable space structures is presented. It has as its main objectives the following: (1) to select optimum composite designs utilizing the elastic recovery principle for expandable space structures; (2) to compare the elastic recovery concepts with other expandable concepts; and (3) to select optimum applications of the elastic recovery concept for space structures. The elastic recovery concept sandwiches a compressible core between two or more flexible facings. The material used in the construction permits the structure to be alternately folded and compressed into an extremely small-volume container. J.R.C.

N64-23726 Northrop Corp., Hawthorne, Calif. Space Labs.
VARIABLE GEOMETRY SPACE STRUCTURES
H. L. Sujata *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 535–547 refs (See N64-23701 16-01)

This study concentrates on the variable geometry (VG) concepts that introduce to the structural engineer a new set of arrays that can be developed to form a broad spectrum of structural shapes for application in space. The basic structural elements of the VG frame-structure system are the arch and base ring. By attaching arches around the base ring and thereby providing the means of hinging and activation, the arches can be rotated and made to assume the desired configuration. J.R.C.

N64-23731 Lockheed-California Co., Burbank
EXPANDABLE STRUCTURES—RECOMMENDATION FOR THE FUTURE
R. B. Liddell and S. L. Lieberman *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 653–673 (See N64-23701 16-01)
(AF 33(657)-8776)

The growing interest in expandable structures for space applications is a consequence not only of significant volume and weight reductions, but also of the unique configuration possibilities inherent in development and rigidization in the space environment. It is apparent that a closer liaison between the designers and the materials engineers is essential to the future use of expandable structures, particularly for reentry applications. J.R.C.

N64-23851* Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.
ROCKET BOOSTER CONTROL SECTION 8: LINEAR PROGRAMMING AND BOUNDED PHASE COORDINATE CONTROL
D. L. Russell 7 Jan. 1964 16 p refs
(Contract NASw-563)
(NASA-CR-56650; MH-MPG-1541-TR-8) OTS: $1.60 ph

A maximum principle for time-optimal bounded-phase coordinate control of ordinary linear differential equation systems and an existence theorem are proven. Plant differential equations are then approximated by recurrence equations so the problem of obtaining "optimal" trajectories by backing out of the origin can be reduced to one of linear programing. Author

N64-23901* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN INTEGRATED SYSTEM FOR COLLECTING AND ANALIZING ENVIRONMENTAL TEST DATA
Philip Yaffee, Fred Starbuck, James W. Bailey, Clifford W. Scott, Augustus C. Johnson et al (Booz-Allen Appl. Res., Inc.) Washington, NASA, Jun. 1964 17 p
(NASA-TN-D-2322) OTS: $0.50

The simultaneous evaluation of several spacecraft in simulated space environments results in a large volume of data relating to the performance of the spacecraft and to the generation and measurement of the environment. The timely and effective collection, processing, and reduction of these data can only be achieved by means of an automatic data-handling system. Such a data system has been designed and installed at Goddard Space Flight Center. It organizes and reduces the data generated, both as an aid to effective control of test operations and for optimum analysis and storage of the test data. Author

N64-23914* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CRYOGENIC STORAGE FOR SPACE ELECTRICAL POWER
William A. Chandler Repr. from Astronautics and Aerospace Eng., May 1963 p 97–101 refs
(NASA-RP-220)

Cryogenic storage systems capable of operating in zero gravity for extended periods of time are discussed. Comparison is made of three types of systems—high-pressure gaseous storage system, supercritical cryogenic system, and subcritical cryogenic system. Supercritical storage offers the most simplicity in operation, with inherent reliability and availability of system components, and has been chosen for both Gemini and Apollo. It offers a weight saving and has good volumetric efficiency. E.C.

N64-23931* Lockheed Missiles and Space Co., Sunnyvale, Calif.
FACTORY TEST PLAN
21 May 1963 13 p Presented at the RIFT Mfg. Eng. Working Group Meeting
(Contract NAS8-5600)
(NASA-CR-56235; NSP-63-62) OTS: $1.60 ph

The RIFT factory-test-plan operations at each phase of manufacture will be conducted according to one or more of the following operations: source inspection; receiving inspection, serialization and process-control numbering; functional test; nondestructive test; tool and gage (calibration) test; subassembly test; final checkout; shipping inspection; and transportation inspection. P.V.E.

N64-24000* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESULTS OF ACOUSTICAL SURVEY OF SA-2 LAUNCH
Wade D. Dorland and Richard N. Tedrick 20 Aug. 1962 72 p refs
(NASA-TM-X-51699; MTP-TEST-62-5) OTS: $7.60 ph

The data obtained from the measurements are presented and are processed to show the variations of the sound levels in relation to both time and frequency during the launch. While the vehicle was restrained on the launch pedestal, sound pressure levels (SPL's) of 145 to 150 db were measured on the pedestal and at a 150-ft radius from the vehicle. Levels in the underground utility rooms were in the range of 110 to 116 db. On the complex, beyond the pad, levels of 120 to 145 db were found during the restrained phase of the flight, but after liftoff the levels reached a maximum, in the range of 134 to 144 db, when the lobe of most intense radiation passed over the individual measurement sites. The frequency spectra for measurements on the 600-ft radius from pad center generally peaked between 125 and 500 cps, and the peak was below 100 cps for the measurements on the 1,200-ft radius. Author

N64-24021* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE SITUATION REPORT, Vol. 4, No. 11
15 Jun. 1964 12 p
(NASA-TM-X-51782; X-533-63-1) OTS: $1.60 ph

Data presented in this report covers objects launched from January 1958 through June 1964. I.v.L.

N64-24055* Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
THOR DELTA DESCRIPTION AND PAYLOAD CAPABILITY
W. H. Hooper Apr. 1962 26 p
(Contract NAS7-220)
(NASA-CR-56312; SM-41470) OTS: $2.60 ph

The payload capabilities of the Thor Delta launch vehicle for polar, circular, and elliptical orbits, as well as for space probes, are examined. The performance characteristics of the propulsion system are included, along with a description of the Thor Delta vehicle. J.L.D.

N64-24111* Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Dept.
ROCKET BOOSTER CONTROL: PENALTY FUNCTIONS AND BOUNDED PHASE COORDINATE CONTROL Section 7
D. L. Russell 16 Jan. 1964 28 p refs Previously published as NASA-CR-59; see N64-21054 14-20
(Contract NASw-563)
(NASA-CR-56651; NASA-CR-59; MH-MPG-1541-TR-7) OTS: $2.60 ph

The use of two different kinds of penalty functions to obtain approximate and, in the limit, exact solutions to the bounded-phase-coordinate optimal control problem is considered. The first type of penalty function assumes small values within the phase constraint and large values outside, whereas the second type is defined only within the phase constraints, assuming small values away from the constraint boundary but increasing to infinity as that boundary is approached. The bounded, or constrained phase problem is replaced by a new problem in which the constraints are formally removed but the cost functional is augmented by adding a penalty function of one of the above types. Author

N64-24122* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
TAIL SERVICE MAST DESIGN REPORT. SATURN V GROUND SUPPORT EQUIPMENT, LAUNCH COMPLEX 39
8 May 1964 286 p
(NASA-TM-X-51767; TM-23-0-D) OTS: $18.00

This preliminary design handbook contains information covering the overall design, function, and engineering of the tail service mast. Information pertaining to schedules, location, and testing of the prototype is presented. A design analysis section is included that derives the feasibility of the tail service mast. Author

N64-24148 Boeing Co., Seattle, Wash.
DYNA-SOAR A.P.U. THERMODYNAMIC SYSTEM Design Analysis Report
29 Apr. 1963 163 p Prepared by Sundstrand-Aviation, Denver, Colo., for Boeing Co.
(Rept.-24-DER-63; AD-435892)

This report analyzes the design of the Dyna-Soar A.P.U. thermodynamic system in terms of the regenerator, O_2 preheater, and the combustor. The catalytically ignited combustion chamber developed is highly reliable, having no moving parts. The regenerator design is within the stress, pressure, drop, weight, safety, and size limitations necessary for efficient A.P.U. operation. The O_2 preheater is adequate. G.D.B.

31 SPACE VEHICLES (LAUNCH VEHICLES)

Includes boosters; clustered rockets; and multistage rockets. *For propulsion engines see*: 27 Propulsion. *For manned space capsules, satellites, and sounding rockets and space probes see*: 32 Space Vehicles (Spacecraft). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-22938* National Aeronautics and Space Administration. Washington, D.C.
ROTATIONAL EVOLUTION OF A DYNAMICALLY-SYMMETRIC SATELLITE [EVOLYUTSIYA VRASHCHENIYA DINAMICHESKI-SIMMETRICHNOGO SPUTNIKA]

V. V. Beletskiy Mar. 1964 69 p refs Transl. into ENGLISH from Kosmich. Issled., (USSR), v. 1, no. 3, 1963 p 339–386
(NASA-TT-F-8827)

A complete system of equations in terms of oscillating elements is proposed for describing the rotational motion of a dynamically symmetric satellite. By averaging out with respect to one or two rapid variables, the complete system of equations is simplified. In a series of important cases, the averaged system of equations can be completely integrated in closed form. The theory is applied to investigate the motion produced by various perturbation factors; i.e., moments due to gravitational, aerodynamic, and magnetic forces; light pressure; aerodynamic dissipation; and eddy currents. Author

N64-23016 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
THE EFFECT OF AERODYNAMIC LIFT ON SATELLITE ORBITS
G. E. Cook London, Min. of Aviation, Mar. 1964 22 p refs
(RAE-TN-SPACE-58)

The perturbation of satellite orbits by aerodynamic lift is investigated. Two simple variations of lift around the orbit are considered, and the changes in eccentricity and argument of perigee are determined. If a lifting satellite were stabilized in earth axes in a low-altitude near-circular orbit, the observed perturbations could provide valuable information on the nature of the momentum exchange between air molecules and the satellite's surface. Author

N64-23055* National Aeronautics and Space Administration, Washington, D.C.
A CARRIER ROCKET FOR THE NATIONAL SPACE PROGRAM
1964 33 p Transl. into ENGLISH of the Publ. "Eine Trägerrakete für das Nationale Raumfahrtprogramm" W. Germany, 1964
(NASA-TT-F-9012)

The German Federal Republic needs a carrier rocket for testing modern energy production in space, for launching research satellites, and for launching communication satellites. This report proposes the combination of a U.S. Thor rocket with a German high-energy final stage. This carrier rocket would enable Germany to collaborate in all important areas of space flight and exploration. G.D.B.

N64-23227* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SATURN I FLIGHT TEST EVALUATION
F. A. Speer N.Y., AIAA [1964] 16 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-322) AIAA: $0.50 members, $1.00 nonmembers

Saturn I successfully completed five flights. All major test missions were achieved, and an unprecedented volume of system performance data was collected for analysis. Estimate of the amount of data received from the five flights is about 550 million bits. This report briefly covers the research and development flight-test program as well as the actual results of the flights. Information compiled is to help design and build Saturn IB and V. G.D.B.

N64-23234* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A TECHNIQUE FOR THRUST-VECTOR ORIENTATION DURING MANUAL CONTROL OF LUNAR LANDINGS FROM A SYNCHRONOUS ORBIT
L Keith Barker and M. J. Queijo Washington, NASA, Jun. 1964 33 p refs
(NASA-TN-D-2298) OTS: $1.00

An analytical study has been made of the possibility of using visual references as an aid in thrust-vector orientation during lunar landings. The procedure was to compute a gravity-turn descent, and then to examine the thrust-vector orientation relative to the uprange horizon, the downrange horizon, the nominal landing site, and an orbiting spacecraft, to determine whether some simple, useful geometric relationships existed. It was found that during the gravity turn the angle between the thrust vector and the line of sight to the orbiting vehicle remained very nearly constant until the landing was almost completed. The orbiting spacecraft therefore appears to be a convenient reference for manual control of the lander thrust vector. Trajectory computations based on using the line of sight to an orbiting spacecraft for thrust-vector orientation resulted in efficient landings. The effect of errors in thrust direction, thrust magnitude, and initial condition of the lander at initiation of the braking maneuver on terminal condition also was examined. Author

N64-23248* National Aeronautics and Space Administration, Washington, D.C.
NASA REPORTS ON SATURN LAUNCH RESULTS News Release No. 64–160
3 Jul. 1964 7 p
Available from the Scientific and Technical Information Div.

While launch preparations on the seventh Saturn I rocket (SA-7) are proceeding at Cape Kennedy, The National Aeronautics and Space Administration completed the major phase of its evaluation of the SA-6 flight records. According to the NASA news release, the AS-7 flight plan is, for the most part, a duplicate of SA-6. Several minor changes, some of them the result of the SA-6 flight, will be made in the launch vehicle. As a result of good performances in SA-5 and SA-6, two changes in the S-IV stage will be made to lighten the vehicle. Helium storage bottles that had been carried as a backup for the vehicle helium heater will be eliminated, saving about 1,000 pounds. The SA-7 Apollo spacecraft mission will utilize an unmanned boilerplate spacecraft (BP-15) similar to BP-13, the SA-6 mission spacecraft. The reaction control system will be more fully instrumented, and the launch escape subsystem will be jettisoned by using the pitch control and launch escape motors, instead of the jettison rockets. P.V.E.

N64-23268 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
THE LONG-PERIOD MOTION OF THE PLANE OF A DISTANT CIRCULAR ORBIT
R. R. Allan and G. E. Cook London, Min. of Aviation, Dec. 1963 24 p refs
(RAE-TN-SPACE-52)

Earth satellites are considered in the region where the perturbing effects due to oblateness and lunar–solar gravitational forces are comparable. A general solution is obtained for simultaneous precession about any number of fixed axes; this is an extension of Laplace's treatment for the motion of Iapetus about Saturn. Results are given for general orbits on the assumption that the lunar orbit lies in the ecliptic. Synchronous orbits are considered in greater detail. Author

N64-23281 Space Technology Labs., Inc., Canoga Park, Calif.

ATLAS F. VOLUME I: DEVELOPMENT OF MODELS Final Reliability Summary Report for OSTF-2

T.M. Lough et al 15 Nov. 1963 31 p refs

(Contract AF 04(694)-3)

Rept.-6301-6594-RU-000; BSD-TDR-64-8; AD-436837)

This report describes the results of the Atlas F reliability mathematical model study conducted as an analytical part of the OSTF-2 test program. The report defines development of the models, and generation of reliability estimates for various combinations of weapon system operating conditions, includes appendices containing associated studies performed during the program, and the final evaluation of the reliability of the weapon system operating conditions. Author

N64-23349* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LARGE POST-SATURN LAUNCH VEHICLES: WHY? WHEN? WHAT?

William G. Huber N.Y., AIAA [1964] 8 p Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964

(AIAA Paper-64-279) AIAA: $0.50 members, $1.00 nonmembers

The feasible vehicle concepts of post-Saturn launch vehicles are discussed. The study is divided into four clases. Class I contains the concepts using current technology and are essentially within the present state-of-the-art. The configurations are expandable and use propulsion systems currently under development. Class II represents concepts using advanced technology, principally in the areas of propulsion and recovery. Class III concepts utilize very advanced technology, particularly in the areas of propulsion, structures, and recovery from near-orbital velocity. Class IV represents the combination of a Class II or Class III chemical first stage with an advanced nuclear upper stage. N.E.A.

N64-23351* General Dynamics/Astronautics, San Diego, Calif.

THE CENTAUR HIGH ENERGY UPPER STAGE PROGRAM A Status Report

Grant L. Hansen N.Y., AIAA [1964] 4 p Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964

(Sponsored by NASA)

(AIAA Paper-64-294) AIAA: $0.50 members, $1.00 nonmembers

This paper discusses the development of the Centaur space launch vehicle, a high energy space vehicle. A brief history is given of the Centaur's rise from a low priority research effort to explore the feasibility of a hydrogen–oxygen upper stage to a flight-proven high energy space vehicle bearing the nation's highest priority and committed to the U.S. lunar exploration plan. A description is given of the Centaur's RL-10 engines and the structural components that enable it to be combined to the Atlas vehicle. The current Centaur flight program is outlined, and the Centaur future possibilities are discussed. N.E.A.

N64-23376 Royal Aircraft Establishment, Farnborough (Gt. Brit.)

A CAMERA WITH ENHANCED LIGHT GRASP FOR PRECISE SATELLITE RECORDING

P. B. N. Nuttall-Smith London, Min. of Aviation, Oct. 1963 26 p refs

(RAE-TN-IR-30)

For recording the transits of artificial earth satellites, a camera with sinusoidal rocking motion in the direction of satellite motion has a number of advantages. There is a gain in light grasp, in comparison with a fixed camera using a similar lens, and the method is comparatively insensitive to errors in speed setting. This gain is compared with that achieved in Opik's vibrating meteor camera and also with a tracking camera. The rocking camera is superior to the tracking camera whenever the speed error exceeds a very few percent. Even for large errors in matching the speed there is still a useful gain relative to a stationary camera. The form of record allows precise measurement of satellite position relative to the stars at a series of instants that can be related to standard time to comparable precision. This accuracy is unaffected by any speed error. The system is potentially capable of being operated by a clock switch after presetting, thus avoiding the need for an observer at night. The gain in light grasp achieved is less than is predicted by the computed augmentation of exposure. This is in part attributable to the difference in perception of lines and dots, particularly against a noisy background. Author

N64-23425 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

AUTOMATIC STATIONS FLY TO THE PLANETS

Yuriy Marinin 29 Mar. 1963 7 p Transl. into ENGLISH from Turkmenskaya Iskra (USSR), 30 Nov. 1962 p 4

(FTD-TT-63-301/1+4; AD-402442)

Two automatic space stations are discussed, Mariner II and Mars I. Mariner II, which will bypass Venus, is intended for an investigation of the planet's magnetic field, a determination of its atmosphere, and a measurement of the surface temperature. The main task of Mars I is to photograph the planet Mars. In this report, emphasis is placed on the solar and chemical batteries of Mariner II. I.v.L.

N64-23429 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MISTRESS OF THE STRATOSPHERE REPORT FROM BOARD A ROCKET CARRIER

Ye. Smirnov 8 Jan. 1964 8 p Transl. into ENGLISH from Krasnaya Zvezda (Moscow), v. 194, 17 Aug. 1963 p 1

(FTD-TT-63-943/1; AD-430377)

Presented is a newspaperman's account of his flight aboard an intercontinental bomber on a practice mission. P.V.E.

N64-23635 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

HOW THE SECOND SATELLITE WAS DESIGNED

In its Stations in Space 10 Feb. 1964 p 1–4 (See N64-23634 16-01)

The second Soviet artificial satellite is described. Its brightness exceeded the first satellite by several stellar magnitudes. Total weight of the satellite, its animal passenger, and electric power sources was 508.3 kg. A special frame carried an instrument to investigate solar radiation. Radio transmitters were housed in a spherical container and operated at frequencies of 40.002 mc and 20.005 mc. There was an airtight cabin containing the passenger—a dog. This cabin was made of aluminum alloys. Electric power sources providing current to scientific and measuring devices were mounted on the body of the last stage of the rocket. The entire satellite was geared for 7-day trip. A.W.

N64-23636 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE SECOND SATELLITE
Yu A. Pobedonostsev *In its* Stations in Space 10 Feb. 1964 p 4–9 (See N64-23634 16-01)

Reported are the achievements of the second Soviet satellite. The accuracy of initial computations was proved, optimum trajectory for orbit was correctly determined, performance of optical and radar apparatus occurred as predicted, information was secured on terrestrial gravity and atmospheric density, and data were obtained on solar short-wave radiation. A.W.

N64-23637 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE FLYING SPACE LABORATORY
I. I. Sedov *In its* Stations in Space 10 Feb. 1964 p 10–11 (See N64-23634 16-01)

The third artificial earth satellite was launched on 15 May 1958 with the objective of carrying out geophysical investigations in the upper layers of the atmosphere. Especially important was its telemetric apparatus intended to relay information on how photons and nuclei of heavy elements are distributed in cosmic rays. Successful achievement is claimed in these objectives. A.W.

N64-23641 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ARTIFICIAL EARTH SATELLITES AND THE PROBLEMS OF SPACE FLIGHT
N. P. Barabashov *In its* Stations in Space 10 Feb. 1964 p 33–38 (See N64-23634 16-01)

The problems involved in space study and the creation of extra-terrestrial space studies are philosophically discussed. It is stated that an artifical lunar satellite and the launching of an interplanetary rocket must precede manned flights to the planets. A.W.

N64-23702 Aeronutronic, Newport Beach, Calif.
THE SHAPE OF THINGS TO COME IN EXPANDABLE SPACECRAFT
D. G. Younger *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 11–61 refs (See N64-23701 16-01)

The interdependence of structural concepts, materials, and the human factor in the design of expandable spacecraft are reviewed. A wide range of nonrigid and semirigid concepts, either under development or recently conceived, are discussed, with emphasis on mission requirements and booster capability. The merits of the related composite wall cross sections for these configurations are considered in detail. Specific topics covered are those of the geometrical aspects of packaging and deploying of expandable concepts, meteoroid penetration resistance, thermal control, attenuation of penetrating radiation, and structural efficiency. Author

N64-23703 Goodyear Aerospace Corp., Akron, Ohio
AIRMAT STRUCTURES FOR SPACE AND LIMITED WAR APPLICATIONS
J. T. Harris *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 62–73 (See N64-23701 16-01)

An investigation is made of inflatable structures that are useful in space exploration. The initial usefulness of basic inflatable structures, such as spheres, cylinders, and cones, has led to the connecting of cylinders together to form reasonably flat-type panels or to completely woven panels, called AIRMAT, whose space applications are unlimited. J.R.C.

N64-23707 Air Force Systems Command, Wright-Patterson AFB, Ohio Aero Propulsion Lab.
SPACE MAINTENANCE HANGAR CONCEPTS
C. B. May, P. N. Van Schaik, and F. W. Forbes *In its* Aerospace Expandable Struct. Mar. 1964 p 137–167 refs (See N64-23701 16-01)

A discussion is presented on the justification, requirements, and possible structural concepts for a space hangar. This paper covers the general results of the Air Force Space Maintenance Programs, requirements for a maintenance hangar, design concepts for maintenance-hangar criteria, and recommendations for future work in this area. J.R.C.

N64-23712 Cincinnati U., Ohio
EXPANDABLE LUNAR SHELTER CONCEPTS
Karl H. Merkel and James M. Alexander *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 255–284 (See N64-23701 16-01)

A study is made of methods of providing shelter for the personnel, material, and supplies for a manned lunar base. The lunar shelter is to be completely prepackaged, supplied, and built on earth, and utilizes the capsule shell of the package as the structural members. The shell will be filament-wound asbestos–phenolics. The cylindrical shell will fuse into equal halves by using silicone–hydraulics to separate the sections 9 feet apart, with solid-insulated folding partitions expanding simultaneously with the division of the shells, guaranteeing always an earth-type environment within the station. J.R.C.

N64-23714 North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
SELF-DEPLOYING SPACE STATION
E. A. Weber *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 319–339 (See N64-23701 16-01)

Both space-station concepts discussed herein—one involving two-mode deployment and the other utilizing telescoping spokes—are expandable structures in that the orbital configuration must be packaged or folded to be compatible with the aerodynamic restraints imposed on the launch vehicle. These studies have conclusively demonstrated that systems requiring the use of expandable structures can be subjected to creative-design approaches to eliminate many of the problems normally associated with the expandable structures. J.R.C.

N64-23933* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE SITUATION REPORT, VOLUME 4, NUMBER 8
30 Apr. 1964 12 p
(NASA-TM-X-51694; X-533-63-1) OTS: $1.60 ph

The following information is presented for objects in orbit as of 1,200 Z, April 30, 1964: code name, source (country of origin), launch date, nodal period, inclination, apogee, perigee, and transmitting frequency. Also included is information (source, launch date, and decay date) on objects that decayed between April 23 and April 27, 1964. P.V.E.

32 SPACE VEHICLES (SPACECRAFT)

Includes manned space capsules; satellites; and sounding rockets and space probes. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-23997* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE SITUATION REPORT, VOLUME 4, NUMBER 9
15 May 1964 26 p
(NASA-TM-X-51713; X-533-63-1) OTS: $2.60 ph

Included is a listing of objects in orbit as of 1200Z May 15, 1964 and of objects that have decayed from orbit. Information presented on objects in orbit includes: code name, source (country of origin), launch date, nodal period, inclination, apogee, perigee, and transmitting frequency. The list of decayed objects includes all objects that have decayed as of May 15, 1964 and gives the following information: code name, source, launch date, and decay date. P.V.E.

N64-24051* Hughes Aircraft Co., Culver City, Calif. Aerospace Group
RIGIDIZED INFLATABLE SOLAR ENERGY CONCENTRATORS Third Quarterly Progress Report, Feb.–May 1964
S. Schwartz May 1964 26 p
(Contract NAS1 3244)
(NASA-CR-56457) OTS: $2.60 ph

The investigation of polyester syntactic foams did not result in a satisfactory system. Solid, low-shrink polyester resins were investigated, and two materials, Wyandotte PR 242 and FMC Dapon M, showed promise. Adhesion tests indicated that the polysulfide material, CS2414, is the best primer for polyester resins. The use of the lightest weight fabric, combined with as low a resin content as possible, results in the best optics with the polyester system. Techniques were developed for distributing the epoxy syntactic foam evenly, using a wedge-type spreader bar. A series of tests were made to determine the causes and possible remedies for the postcure Mylar blistering. Evacuation before cure and a vacuum postcure give the best results. Two new epoxy hardener systems curing at 200° F were investigated for use in the syntactic foam. Author

N64-24153 General Dynamics/Astronautics, San Diego, Calif.
DYNAMICS OF THE ATLAS 5-CPS LONGITUDINAL OSCILLATION FOLLOWING LAUNCH AS RELATED TO THE TANK PRESSURE REGULATION SYSTEM. VOLUME I: LONGITUDINAL MODEL DEVELOPMENT
R. G. Rose 31 Dec. 1963 80 p
(Contracts AF 04(694)-196; AF 04(694)-240)
(GD/A-63-0712; AD-435036)

This report presents the results of the longitudinal model development necessitated by a 5-cps longitudinal oscillation study of the last Atlas/Mercury flight and extended to space launch vehicles. To develop such a model, pressure changes of the gas in each tank ullage had to be considered. The vehicle model finally developed is a combination of two tank models coupled to other structural lumped-parameter elements. The first vehicle mode frequency was compared to the average frequency for 7 Atlas/Mercury vehicles at a flight time of 5 sec. Results indicated that an exact frequency match can be obtained, using reasonable values for each propellant bulk modulus and a spring rate for the intermediate bulkhead. A.W.

N64-23715 Space-General Corp., El Monte, Calif.
DEVELOPMENT OF AN INFLATED PARAGLIDER FOR MANNED ORBITAL ESCAPE
J. F. Keville and F. Warren *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 340–354 (See N64-23701 16-01)

The specific problem was to develop a material that would possess sufficient flexibility to allow folding into a compact package while being strong enough to withstand the required internal pressure and the aerodynamic loads during flight. Additionally, the material system would have to withstand extreme heating effects during reentry while maintaining low permeability so as to retain the inflation gas. The approach has been toward the use of currently available materials with design criteria based on studies of the related trajectory and thermodynamic environments. The general approach has been to use elastomeric materials with low ablation losses, with yet a relatively modest effective ablation temperature. Since the low thermal conductivity of the elastomers and the ablative char would tend to minimize the transfer of heat to the reinforcing material, the design allows the use of available reinforcing wire cloth. Results of testing performed to date are disclosed and include evaluation of various elastomers by plasmajet tests and torch tests, evaluation of various methods of joining the wire cloth, coating the wire cloth with the elastomer, and tests of the composite material. Author

N64-23728 Schjeldahl (G.T.) Co., Northfield, Minn.
DESIGN AND FABRICATION OF INFLATABLE AND RIGIDIZABLE PASSIVE COMMUNICATION SATELLITES (ECHO I AND ECHO II)
In AFSC Aerospace Expandable Struct. Mar. 1964 p 576–604 (See N64-23701 16-01)

A study is made of the design and fabrication of inflatable and rigidizable passive communication satellites (Echo I and Echo II). Further study to reduce the weight of these communication satellites is under way. One technique employs a lenticular-shape reflector that is oriented by means of gravitational gradients. The simplicity, service life, and antijamming characteristics of passive communication satellites make them a very reliable communication tool. J.R.C.

N64-23730 Schjeldahl (G.T.) Co., Northfield, Minn.
ADVANCED RIGIDIZED MEMBRANE MATERIAL DEVELOPMENT
F. H. Bratton, S. J. Stenlund, and Alfred J. Wendt *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 613–652 refs (See N64-23701 16-01)

The requirements for an inflatable rigidizing passive communication satellite are separated into those concerned with: (1) structural requirements; (2) availability; (3) processability of the materials; and (4) the basic radiofrequency requirements. J.R.C.

N64-23844 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
LABOR Selected Articles
5 Dec. 1963 16 p Transl. into ENGLISH from Trud (USSR), 12 Apr. 1962 p 1-2
(FTD-TT-63-1045/1; AD-426671)

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1. A YEAR AFTER THE FIRST FLIGHT Yu. Volynkin and V. Denisov p 1-6 (See N64-23845 16-32)
2. THE FIRST PASSER ALONG INTERPLANETARY PATHS G. Mikhaylovskiy p 7-10 (See N64-23846 16-32)
3. BEYOND THE LIMITS OF THE ATMOSPHERE p 11-13 (See N64-23847 16-32)

N64-23845 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A YEAR AFTER THE FIRST FLIGHT
Yu. Volynkin and V. Denisov *In its* Labor 5 Dec. 1963 p 1-6 (See N64-23844 16-32)

This nontechnical article lauds Soviet achievement in space in its first year of manned spaceflights, mentioning particularly the achievements of Gagarin and Titov, the first two cosmonauts. G.D.B.

N64-23846 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE FIRST PASSER ALONG INTERPLANETARY PATHS
G. Mikhaylovskiy *In its* Labor 5 Dec. 1963 p 7-10 (See N64-23844 16-32)

The flight of Vostok I with Y. Gagarin at the controls is reviewed in this nontechnical article. G.D.B.

N64-23847 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BEYOND THE LIMITS OF THE ATMOSPHERE
In its Labor 5 Dec. 1963 p 11-13 (See N64-23844 16-32)

A Soviet scientist is interviewed for his opinions on the significance of space exploration, particularly concerning its contribution to astronomy; he emphasizes the significance of going beyond the atmosphere to get a clearer picture of the universe. G.D.B.

N64-23870* Pacific Missile Range, Point Mugu, Calif.
THE STRATO-MESOSPHERIC METEOROLOGICAL ROCKET
John E. Masterson *In* NASA Meteorol. Observations Above 21) GPO: $0.40

In surveying the stratomesospheric meteorological rocket, this paper describes the volume of the atmosphere in which meteorological observations are being made with the rocket, the meteorological parameters measured, the vehicles and sensors used, and some methods of data retrieval. The current developments of components of the meteorological rocket system are discussed. The sampling of the atmosphere and the use of the meteorological rocket as a photographic platform are described briefly. Augmentation of the meteorological rocket network is discussed, and the next generation of the meteorological rocket is examined. Author

N64-23903* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EXPLOITATION OF INERTIAL COUPLING IN PASSIVE GRAVITY-GRADIENT STABILIZED SATELLITES
Bruce E. Tinling and Vernon K. Merrick New York, N.Y., AIAA [1963] 10 p refs Presented at AIAA Guidance and Control Conf., MIT, Cambridge, 12-14 Aug. 1963
(AIAA Paper-63-342) AIAA: $0.50 members, $1.00 nonmembers

Inertial coupling permits damping of all the oscillatory motions of a satellite with a single auxiliary body that has a single degree of freedom. A complete linear analysis of the small-angle motion of an example system that employs this principle is presented. The analysis indicates that the responses to static and periodic disturbance torques will limit the possible damping of the torque-free motion by imposing a restriction on the maximum moment of inertia of the auxiliary body. Author

N64-23944* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
THE BEHAVIOR OF LUNAR SATELLITES AND THE DETERMINATION OF THEIR ORBITS: A PRELIMINARY INVESTIGATION
C. R. Gates, ed. 18 Sep. 1962 127 p refs
(Contract NAS7-100)
(NASA-CR-56279; JPL-TM-33-107)

This report on the behavior and tracking of artificial lunar satellites covers analytical and computer treatments of behavioral problems, accuracy of measurements using radio techniques, and results of orbit determination using a simplified model. J.R.C.

N64-24020* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE SITUATION REPORT, VOL. 3, NO. 21
31 Oct. 1963 10 p
(NASA-TM-X-51772; X-533-63-1) OTS: $1.10 ph

This report gives in tabular form the recent status of all manmade satellites orbiting in the fall of 1963. Official name, code name, national origin, launch date, nodal period, inclination, apogee, perigee, and transmitting frequency in megacycles are given. G.D.B.

N64-24117 Office of Research Analyses, Holloman AFB, N. Mex. Science and Eng. Analysis Div.
SMALL PROBE VEHICLE STUDY Performance Summary, V. 1
Gerhard R. Eber et al Dec. 1963 151 p
(ORA-63-14; AD-601748)

This report presents technical information on the first group of small probe vehicles considered under this study. It contains general information data, dimensions, weights, performances, comparison of computed performances with data advertised by manufacturers, and performances observed in actual flights. Included are specifications for the ground-support equipment required and notes on the payload compartment heat-transfer conditions for each different vehicle. Author

N64-24161 RAND Corp., Santa Monica, Calif.
DYNAMIC ANALYSIS OF A PASSIVE SATELLITE STABILIZATION TECHNIQUE
T. B. Garber Apr. 1964 122 p refs
(Contract NASr-21)
(NASA-CR-56541; RM-4048-NASA) OTS: $10.00 ph

A nonlinear analysis of a gravity-stabilized satellite is presented. The analysis takes into account deviations from the desired attitude due to initial errors, due to deviations of the satellite from a circular orbit, and due to external forces such

as radiation pressure. This stabilization concept gives excellent performance in making corrections for initial attitude errors. J.R.C.

33 STRESSES AND LOADS

Includes fatigue; vibration; flutter; and structural tests. *For thermal stress see*: 13 Heat Transfer and Thermodynamics. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 34 Structural Design.

N64-22901 Columbia U., New York, N.Y. Inst. for the Study of Fatigue and Reliability

ON UPPER AND LOWER BOUNDS OF THE PROBABILITY OF FAILURE OF SIMPLE STRUCTURES UNDER RANDOM EXCITATION

M. Shinozuka Dec. 1963 26 p refs

(Contract Nonr-266(91))

(TR-1; AD-431045)

Upper and lower bounds are given for the probability $P_x(T; -\lambda_1, \lambda_2)$ $(\lambda_1, \lambda_2 > 0)$ that a separable process x(t) crosses barriers at $-\lambda_1$ and λ_2 in the interval (0, T] under zero initial condition $x(0) = 0$. The displacement of a damped oscillator with one degree of freedom due to a nonstationary gaussian random input is investigated as an illustration of an analysis that does not require the input to be white noise. If failure of the system is assumed to occur when the absolute value of the displacement exceeds a critical value λ, then $P_x(\infty; -\lambda, \lambda)$ is the probability of failure of the system. Author

N64-22910 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center

RESEARCH ON THE PHOTOELECTRIC DETERMINATION OF STRESSES DUE TO THE DEAD WEIGHT IN PLANE STRUCTURES

P. Locatelli, G. Grandori, and G. Moravia 15 May 1964 16 p ref Transl. into ENGLISH from La Ric. Sci., (Italy), v. 25, no. 1, 1955 p 80–91 Presented at the Colloq. on Photoelasticity and Photoplasticity, Brussels, 29–31 Jul. 1954

(RSIC-176; AD-600687)

For the photoelastic analysis of stresses due to deadweight, a stretching method is proposed that makes possible the manufacture models with materials having a relatively high elastic modulus. The deadweight is artificially increased by imparting to the model an acceleration that is obtained, using elastic devices, by moving the model with a rapid alternating motion or with an accelerated nonperiodic motion. The experimental equipment is described. Results obtained are discussed. The tests were carried out on two models of gravity dams made of araldite and rubber. N.E.A.

N64-23070 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SYMMETRICAL BENDING OF NONSYMMETRICALLY CONSTRUCTED SANDWICH PLATES WITH LIGHTWEIGHT CORES

V. V. Yershov (Kazan Inst. of Aviation) *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 42–63 refs (See N64-23066 16-03)

A solution to the problem of weak cylindrical bending of sandwich plates, whose thickness is nonsymmetrical, at various contour conditions and types of loadings is presented. D.E.R.

N64-23071 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CALCULATIONS FOR TORSION IN FUSELAGE IN REGION OF WING MIDSECTION

S. N. Kan and A. V. Silant'yev (Khar'kov Higher Aviation-Eng. Military Acad.) *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 64–81 (See N64-23066 16-03)

Assuming the presence of a contoured attachment of a wing midsection to a fuselage, results for the stressed state of a round-section fuselage under torsion in the wing region are presented. Both basic and secondary stresses are determined, and the basic rigidity parameters for such fuselage structural materials are derived. D.E.R.

N64-23072 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CALCULATION OF THE STRENGTH OF CONICAL SHELLS OF THE WING WITH SMALL ASPECT RATIO TYPE

Yu. S. Matyushev (Moscow Aviation Inst.) *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 82–94 refs (See N64-23066 16-03)

The strains on strongly tapered shells are determined on the basis of the variational method of Vlasov. Assuming only that the stresses are distributed uniformly over the thickness of a thin-walled shell, differential equations are derived that may be used in the calculation of singly connected and multiply connected conical shells for arbitrary loads and for determination of thermal bimoment stresses in a wing. The resulting problem is easy to program for solution on electronic computers. D.E.R.

N64-23076 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

FLUTTER CALCULATIONS FOR TOWED GLIDER TAKING ACCOUNT OF THREE DEGREES OF FREEDOM

Z. I. Burman (Kazan Inst. of Aviation) *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 136–147 refs (See N64-23066 16-03)

Flutter calculations are determined for a towed glider by taking into account three degrees of freedom. The critical speed and the frequency of oscillation of the system in flutter as calculated with use of the above degrees of freedom are in good agreement with experiment when using a dynamically similar glider model that soars free on a towrope in a wind tunnel. J.R.C.

N64-23153 Lockheed Missiles and Space Co., Sunnyvale, Calif.

MECHANICAL SHOCK FROM FRANGIBLE JOINTS

V. R. Paul *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 63–71 refs (See N64-23151 16-01)

This paper describes the work being done on the frangible joint shock problem, and gives the results obtained to date. The shocks produced from frangible joints during stage separation are of extremely high amplitude (100 to 3000 g) at high frequencies (600 to 6000 cps). Author

N64-23158 General Electric Co., Schenectady, N.Y. Advanced Technology Labs.

REDUCTION OF VIBRATION FROM ROTOR UNBALANCE BY USE OF A FORCE-CANCELING SYSTEM (AN ACTIVE VIBRATION ABSORBER

C. S. Duckwald and T. P. Goodman *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 149–160 Paper not Presented at Symp. (See N64-23151 16-01)
(Contracts NObs-78932; NObs-86829)

Work was undertaken to develop force-cancelling system, in which weights rotating synchronously with the rotor generate unbalanced forces equal and opposite to those of the main rotor. Test results obtained by mounting two force-canceling systems on a three-bearing turbine-generator auxiliary set are discussed. P.V.E.

N64-23161 North Carolina State Coll., Raleigh
DESIGN CONSIDERATION OF LARGE SPACE VEHICLES DUE TO AXIAL OSCILLATIONS CAUSED BY ENGINE-STRUCTURAL COUPLING
D. Mc Donald and T. R. Calvert (Lockheed Missiles and Space Co.) *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 179–188 refs (See N64-23151 16-01)

A sustained longitudinal oscillation occasionally occurs in large space vehicles. The cause and mechanics of this oscillation are reviewed, and experimental data, obtained from ground vibration tests of an elaborate dynamic model, are correlated with flight test data. Author

N64-23162 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
VIBRATIONAL ENERGY LOSSES AT JOINTS IN METAL STRUCTURES
Eric E. Ungar *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 189–199 refs (See N64-23151 16-01)

Experimental and theoretical results are discussed relating to the vibrational energy dissipation at riveted, bolted, and spot-welded joints between metal panels, beams, and supports. Some conclusions are drawn concerning the mechanisms responsible for this damping. Author

N64-23163* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN OF SPACE VEHICLE STRUCTURES FOR VIBRATION AND ACOUSTIC ENVIRONMENTS
C. E. Lifer *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 201–207 refs (See N64-23151 16-01)

The advances in design technology for space-vehicle structural vibrations have not kept pace with improvements in environment definition and testing. As vehicles become larger and more expensive, this gap must be eliminated. The need for a uniform design approach throughout the aerospace industry is presented and a proposed basis is explained. Author

N64-23210 Aircraft Armaments, Inc., Cockeysville, Md.
A PROGRAM TO DETERMINE HIGH BLAST-INDUCED AIRLOADS AND STRUCTURAL RESPONSE OF LIFTING SURFACES
R. L. Jarvis, J. J. Kasper, R. R. Mills, Jr., and I. O. Wolf Wright-Patterson AFB, Ohio, ASD, Mar. 1964 402 p refs
(Contract AF 33(616)-7099)
(ER-2983; ASD-TDR-63-764, Vol. I; AD-436114)

High-blast-induced airloads and the structural response of lifting surfaces are investigated for determining aircraft vulnerability and safety. The structural specimens were designed according to current design practice in order to investigate the failure modes and postfailure behavior of typical wing structures. The experimental data obtained will be used for correlation with theoretical prediction methods. J.R.C.

N64-23253 Joint Publications Research Service, Washington, D.C.
EFFECTS OF Ti AND Al, ETC., ON MECHANICAL PROPERTIES OF NIMONIC 80A
Hasegawa Taro 9 Jun. 1964 11 p refs Transl. into ENGLISH from Tetsu to Hagane (Tokyo), v. 35, Apr. 1959 p 38–43
(JPRS-25005; OTS-64-31443) OTS: $0.50

Effects of Ti, Al, and gas content on stress-rupture characteristics at 750° C and 26.8kg/mm^2 were investigated. Stress-rupture life increased with an increase of Ti + Al to 2.9% Ti and 1.44% Al. Elongation after stress-rupture was small, and the effect of Ti and Al content on it was not clear. Stress-rupture life depends not only on the amount of Ti and Al but also on the amount of nitrogen and oxygen or hydrogen that arises from the melting procedure and from the raw materials. An increase in gas content causes a noticeable decrease in stress-rupture life. Author

N64-23310 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE APPLICATION OF THE THEORY OF TRUE-STRESS CURVES TO VARIOUS TEMPERATURE CONDITIONS OF DEFORMATION
V. Ya. Shekhter 31 Dec. 1963 17 p refs Transl. into ENGLISH from the Book "Protsessy Shtampovki i Ikh Tekhnologicheskiye Parametry" Mosk. Avtomekhan. Inst., 1959 p 146–154
(FTD-TT-63-768/1+2+4; AD-435497)

A new dependence between true stresses and deformations is proposed. The new dependence makes it possible to extend the theory of true-stress curves, used earlier only for cold deformation, to all kinds of deformation caused by different temperature conditions of deformation. The path of the true-stress curves for different temperature conditions and the specific features of the final segment of the contraction-true-stress diagram are ascertained. Author

N64-23339* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE PREDICTION OF NOTCH AND CRACK STRENGTH UNDER STATIC OR FATIGUE LOADING
Paul Kuhn N.Y., SAE [1964] 11 p refs Presented at the SAE Air Transport and Space Meeting, N.Y., 27–30 Apr. 1964
(SAE Paper-843c)

This paper discusses a method of notch analysis intended to deal with notch problems in a unified manner. Development of the method has taken place in three main steps. In the first step, a formula based on considerations of size effect was developed into a method for computing fatigue notch factors and was applied to parts made of low-alloy steels. In the second step, plasticity considerations were added, enabling the computation of static strength factors for notches and cracks; extensive applications involving statics as well as fatigue notch factors for wrought aluminum alloys were presented. In the third step, the amplified method was applied to compute static strength factors for titanium alloy parts at cryogenic and elevated temperatures. N.E.A.

N64-23447 Joint Publications Research Service, Washington, D.C.
METAL FATIGUE AND CYCLIC STRESS

17 Jun. 1964 36 p refs Transl. into ENGLISH from the Book "Prochnost' Metallov Pri Peremen. Nagruzkakh" (Moscow, Publishing House of the USSR Acad. of Sci., 1963 p 3–22
(JPRS-25124; OTS-64-31503) OTS: $1.00

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1. DISLOCATION THEORIES OF FATIGUE CRACKS FORMATION I. A. Oding and V. S. Ivanova p 1—18 refs (See N64-23448 16-33)

2. THE CHANGE OF DISLOCATION STRUCTURE OF METALS DURING CYCLICAL STRESS V. S. Ivanova p 19–33 refs (See N64-23449 16-33)

N64-23448 Joint Publications Research Service, Washington, D.C.
DISLOCATION THEORIES OF FATIGUE CRACKS FORMATION
I. A. Oding and V. S. Ivanova *In its* Metal Fatigue and Cyclic Stress 17 Jun. 1964 p 1–18 refs (See N64-23447 16-33) OTS: $1.00

The causes for the onset of fatigue cracks are considered briefly, and an analysis of them is given. According to dislocation theories, brittle destruction precedes plastic deformation. J.R.C.

N64-23449 Joint Publications Research Services, Washington, D.C.
THE CHANGE OF DISLOCATION STRUCTURE OF METALS DURING CYCLICAL STRESS
V. S. Ivanova *In its* Metal Fatigue and Cyclic Stress 17 Jun. 1964 p 19–33 refs (See N64-23447 16-33) OTS: $1.00

The change of dislocation structure of metals during cyclic stress is investigated. The results of investigations conducted on iron silicide and several brands of steel are presented. J.R.C.

N64-23493 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EQUILIBRIUM EQUATIONS FOR STATIC BENDING AND FREE VIBRATION OF IRREGULARLY SHAPED CANTILEVER PLATES
B. E. Sivehikov *In its* News of Higher Education, Aeron. Eng. 27 Mar. 1963 p 14–26 refs (See N64-23491 16-01)

A generalized method for calculating bending in cantilever plates with straight sides arbitrarily placed with respect to one another is presented. The equilibrium equation of a cantilever plate with static bending and free vibration is derived by the method of variations. It is assumed that the plate is homogeneous and isotropic and that its deformation follows Hook's law. It is also assumed that the theory of bending for thin rigid plates is correct. P.V.E.

N64-23601 Franklin Inst., Philadelphia, Pa.
AN EXPERIMENTAL INVESTIGATION OF THE FATIGUE LIFE AND LIMIT LOAD CHARACTERISTICS OF NEEDLE ROLLER BEARINGS UNDER OSCILLATING LOAD CONDITIONS
J. S. Tawresey and W. W. Shugarts, Jr. Wright-Patterson AFB, Ohio, Res. and Technol. Div., Mar. 1964 147 p refs
(Contract AF 33(616)-3589)
(FIL-F-A1913; SEG-TDR-64-4; AD-437467)

A field survey was made to guide selection of an appropriate size and type of bearing for test (caged, needle roller), and to establish the principal operating variables. Each test bearing was subjected to fixed conditions of load, speed, amplitude of oscillation, and lubrication (grease or oil). It was run continuously until evidence developed of incipient failure in the form of spalling or flaking breakout of the raceways. The elapsed time in test, prior to failure, marks the life of the bearing. The basis of an oscillating load capacity rating for the test bearing is presented and forms the basis for life prediction. A grease lubricant exhibited longer B-10 life with this test bearing than an oil lubricant under the controlled conditions of these laboratory tests. Effects on the B-10 life of both the speed and the amplitude of oscillation were revealed in these tests. Author

N64-23693 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EQUATIONS OF EQUILIBRIUM AND OSCILLATIONS OF THREE-LAYER SHELLS OF ASYMMETRICAL STRUCTURE
M. I. Il'eamov *In its* News of Higher Educ., Aeron. Eng. 28 Oct. 1963 p 13–27 refs (See N64-23691 16-34)

Lagrange's variation equation is used to obtain equations of motion and boundary conditions for orthotropic three-layer shells of asymmetrical structure with a filler deformable as to thickness. The free oscillations and strength of three-layer (sandwich) plates are also considered. P.V.E.

N64-23708 Geophysics Corp. of America, Bedford, Mass. Viron Div.
EXPANDABLE SELF-RIGIDIZING HONEYCOMB STRUCTURES
I. Russell, N. Hanssen, W. Mc Killip, B. Culbertson, and R. Slagel (Archer-Daniels-Midland Corp.) *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 168–191 (See N64-23701 16-01)

This study of expandable self-rigidizing honeycomb structures shows the feasibility of utilizing these structures for both space and terrestrial application. Also, the feasibility of using this technique for the fabrication of solar-energy concentrators, with the extreme requirement for reflective-surface regularity, is demonstrated. J.R.C.

N64-23713* National Aeronautics and Space Administration. Washington, D.C.
NASA RESEARCH ON EXPANDABLE STRUCTURES
Norman J. Mayer *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 285–318 refs (See N64-23701 16-01)

Expandable structures were or may be utilized in space missions as passive communication satellites, antennas, solar power systems, recovery and reentry systems, space laboratories, lunar bases, and many items of equipment. Research in materials and structures is being directed toward solving the common problems in these applications and to advancing the technology. Special emphasis should be given to nonmetallic materials in filamentary form. More research is needed to broaden the field and develop the potential that expandable structures possess. Author

N64-23732 North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
ON THE STRUCTURAL BEHAVIOR OF INFLATED FABRIC CYLINDERS UNDER VARIOUS LOADING CONDITIONS
L. Kovalevsky and F. L. Rish *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 674–701 (See N64-23701 16-01)

This paper introduces an analytical method for predicting structural behavior of inflatable fabric cylinders. The behavior is dependent on the anisotropic and the large deflection stress–strain characteristics of the fabric material. J.R.C.

N64-23831 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
USE OF X-RAYS IN THE INVESTIGATION OF MATERIALS
16 Jan. 1964 240 p refs Transl. into ENGLISH of the book "Primeneniye Rentgenovykh Luchey K Issledovaniyu" Materialov" Leningrad, Izd. Leningr. Univ., 1959 p 3–127 (FTD-TT-63-671/1+2+4; AD-431971)

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2. X-RAY INVESTIGATION OF FATIGUE OF SINGLE CRYSTALS OF ALUMINUM AT NORMAL AND LOW TEMPERATURES Yu. S. Terminasov and Sh. Kh. Yar-Mukhamedov p 41–61 refs (See N64-23833 16-33)

3. X-RAY INVESTIGATION OF THE MECHANISM OF FATIGUE OF SINGLE CRYSTALS OF METALS AT NORMAL AND LOW TEMPERATURES Yu. S. Terminasov and Sh. Kh. Yar-Mukhamedov p 62–90 refs (See N64-23834 16-33)

4. X-RAY INVESTIGATION OF THE DISTORTIONS OF THE CRYSTALLINE STRUCTURE OF STEEL 45, ALUMINUM, AND RED COPPER SUBJECTED TO FATIGUE TESTING Yu. S. Terminasov and A. M. Toropov p 91–108 refs (See N64-23835 16-33)

5. X-RAY INVESTIGATION OF EFFECTS OF THE SECOND AND THIRD KIND DURING FATIGUE OF SILICON STEEL Ya. I. Mar'yanovskiy p 109–134 refs (See N64-23836 16-33)

6. X-RAY INVESTIGATION OF THE SURFACE LAYERS OF A METAL DURING ROLLING FRICTION V. D. Sergeyeva p 135–140 refs (See N64-23837 16-33)

7. X-RAY INVESTIGATION OF DISTORTIONS OF THE STRUCTURE OF STEEL 45 DURING ROLLING FRICTION V. D. Sergeyeva p 141–150 refs (See N64-23838 16-33)

8. X-RAY INVESTIGATION OF RESIDUAL STRESSES OF THE FIRST AND THIRD KIND DURING WEAR OF STEEL SPECIMENS IN THE PROCESS OF FRICTION T. Karashev and Yu. S. Terminasov p 151–173 refs (See N64-23839 16-33)

9. X-RAY INVESTIGATION OF THE WEAR OF METALS WITH A PREHARDENED SURFACE A. M. Abdullina and Yu. S. Terminasov p 174–190 refs (See N64-23840 16-33)

10. INVESTIGATION OF THE SHOT-PEENING OF STEEL BY THE X-RAY METHOD Yu. G. Myasnikov and Yu. S. Terminasov p 191–205 refs (See N64-23841 16-33)

11. X-RAY INVESTIGATION OF DISTORTIONS OF THE CRYSTALLINE STRUCTURE IN THE SURFACE LAYERS OF METALS SUBJECTED TO POWER CUTTING A. Alybakov and Yu. S. Terminasov p 206–229 refs (See N64-23842 16-33)

12. AN ELECTRIC VACUUM FURNACE WITH A DEVICE FOR LOADING SPECIMENS WITHOUT DISTURBING THE VACUUM G. A. Feklistov p 230–233 (See N64-23843 16-33)

N64-23832 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
X-RAY INVESTIGATION OF THE FATIGUE MECHANISM OF ANNEALED AND PREWORKHARDENED STEEL
V. N. Buyko and Yu. S. Terminasov *In its* Use of X-rays in the Invest. of Mater. 16 Jan. 1964 p 3a–40 refs (See N64-23831 16-33)

Three kinds of steel were chosen as material for investigation—steel 20, steel 45, and chromel-nickel-molybdenum steel brand 35 KhNM. Conclusions are presented of X-ray investigations for reverse bending at cyclic stresses below the fatigue limit, at the fatigue limit, and beyond it, at different numbers of cycles. For the first time, the concept of a fatigue criterion based on a change in the intensity of X-ray interferences was extended to pre-work-hardened carbon steels, as well as to alloy steel. G.D.B.

N64-23833 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
X-RAY INVESTIGATION OF FATIGUE OF SINGLE CRYSTALS OF ALUMINUM AT NORMAL AND LOW TEMPERATURES
Yu. S. Terminasov and Sh. Kh. Yar-Mukhamedov *In its* Use of X-rays in the Invest. of Mater. 16 Jan. 1964 p 41–61 refs (See N64-23831 16-33)

To study the process of metal failure resulting from fatigue, single-crystal specimens were used to explain a number of details of the physical mechanism of metal fatigue. The single crystals were cultivated by recrystallization because crystals cultivated from a melt have defects determined by the conditions of growth. Conclusions are reported on this X-ray investigation of single-crystal fatigue of aluminum at normal and at low temperatures. G.D.B.

N64-23834 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
X-RAY INVESTIGATION OF THE MECHANISM OF FATIGUE OF SINGLE CRYSTALS OF METALS AT NORMAL AND LOW TEMPERATURES
Yu. S. Terminasov and Sh. Kh. Yar-Mukhamedov *In its* Use of X-rays in the Invest. of Mater. 16 Jan. 1964 p 62–90 refs (See N64-23831 16-33)

A comparison of the results of reverse cyclic bend tests of single crystals of aluminum, copper, and iron at room temperatures showed that the mechanism of the process was different in each of the cases. G.D.B.

N64-23835 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
X-RAY INVESTIGATION OF DISTORTIONS OF THE CRYSTALLINE STRUCTURE OF STEEL 45, ALUMINUM, AND RED COPPER SUBJECTED TO FATIGUE TESTING
Yu. S. Terminasov and A. M. Toropov *In its* Use of X-rays in the Invest. of Mater. 16 Jan. 1964 p 91–108 refs (See N64-23831 16-33)

A comparative investigation of pure and nonferrous metals was conducted using X-ray techniques. This investigation showed that the fatigue process for ferrous and nonferrous metals is characterized by the development of block structure, by microdistortions, and by the fact that at low temperatures the heat effect is eliminated. The X-ray criterion of fatigue for annealed specimens is of value only after the effect of extinction has been eliminated by fragmentation of the crystalline blocks. G.D.B.

N64-23836 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
X-RAY INVESTIGATION OF EFFECTS OF THE SECOND AND THIRD KIND DURING FATIGUE OF SILICON STEEL
Ya. I. Mar'yanovskiy *In its* Use of X-rays in the Invest. of Mater. 16 Jan. 1964 p 109–134 refs (See N64-23831 16-33)

Under cyclic stresses below the fatigue limit, effects of the second kind develop, starting only at stresses amounting to 60% of the limit. This conclusion and others are discussed in this report of X-ray investigation of the effects of the second

and third kind during fatigue of silicon steel. G.D.B.

N64-23837 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
X-RAY INVESTIGATION OF THE SURFACE LAYERS OF A METAL DURING ROLLING FRICTION
V. D. Sergeyeva *In its* Use of X-rays in the Invest. of Mater. 16 Jan. 1964 p 135–140 refs (See N64-23831 16-33)

A pre-work-hardened surface layer of steel 45, subjected to rolling friction fragmentation of the blocks, and microdistortions as functions of the load, develops up to 40 to 50 kg. The rolling time has almost no effect on the microdistortions and fragmentation of the blocks. The absolute wear varies linearly as a function of the rolling time and of the load on the specimen. G.D.B.

N64-23838 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
X-RAY INVESTIGATION OF DISTORTIONS OF THE STRUCTURE OF STEEL 45 DURING ROLLING FRICTION
V. D. Sergeyeva *In its* Use of X-rays in the Invest. of Mater. 16 Jan. 1964 p 141–150 refs (See N64-23831 16-33)

Fragmentation of the crystalline blocks in annealed specimens develops with a change in the load of up to 60 kg with subsequent stabilization. Microdistortions of the crystalline structures, fragmentation of the crystalline blocks, and changes in microhardness are discussed in relation to the problems of friction and wear of metals. G.D.B.

N64-23839 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
X-RAY INVESTIGATION OF RESIDUAL STRESSES OF THE FIRST AND THIRD KIND DURING WEAR OF STEEL SPECIMENS IN THE PROCESS OF FRICTION
T. Karashev and Yu. S. Terminasov *In its* Use of X-rays in the Invest. of Mater. 16 Jan. 1964 p 151–173 refs (See N64-23831 16-33)

The most reliable results of investigation of residual stresses of the first and third kind during wear of steel specimens in the process of friction can be obtained using the weighing method, measurements of microhardness, and X-ray analysis. This report discusses the use of these techniques and the development of distortions of the third kind in the surface layers of metal during friction. G.D.B.

N64-23840 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
X-RAY INVESTIGATION OF THE WEAR OF METALS WITH A PREHARDENED SURFACE
Z. M. Abdullina and Yu. Z. Terminasov *In its* Use of X-rays in the Invest. of Mater. 16 Jan. 1964 p 174–190 refs (See N64-23831 16-33)

The friction on the surface of specimens of annealed steel U8, subjected to various preliminary hardening treatments, is characterized by the development of a block structure and of microdistortions in its crystalline structures. The process of wear of hardened specimens of steel U8, subjected to various forms of hardening treatment, differs in its mechanism from the process of wear of annealed and pretreated specimens. G.D.B.

N64-23841 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF THE SHOT-PEENING OF STEEL BY THE X-RAY METHOD
Yu. G. Myasnikov and Yu. S. Terminasov *In its* Use of X-rays in the Invest. of Mater. 16 Jan. 1964 p 191–205 (See N64-23831 16-33)

It was established that during shot-peening an increase in microdistortions occurs in the surface layers of steel specimens; the change in hardness as the treatment time increases corresponds to a change in the microdistortions. The purpose of the article was to study changes occurring in the atomic crystal lattice of steel 60S2A and 45 KhNMFA under various peening conditions. G.D.B.

N64-23842 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
X-RAY INVESTIGATION OF DISTORTIONS OF THE CRYSTALLINE STRUCTURE IN THE SURFACE LAYERS OF METALS SUBJECTED TO POWER CUTTING
A. Alybakov and Yu. S. Terminasov *In its* Use of X-rays in the Invest. of Mater. 16 Jan. 1964 p 206–229 refs (See N64-23831 16-33)

An X-ray examination was made of the changes in the size of the crystalline blocks and in the microdistortions when steel 45 is turned by a Kolesov cutter. The method of harmonic analysis was used in calculations of X-ray photographs. The change in size of the crystalline blocks and in the microdistortions on the treated surface depended on the turning conditions. G.D.B.

N64-23843 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AN ELECTRIC VACUUM FURNACE WITH A DEVICE FOR LOADING SPECIMENS WITHOUT DISTURBING THE VACUUM
G. A. Feklistov *In its* Use of X-rays in the Invest of Mater. 16 Jan. 1964 p 230–233 (See N64-23831 16-33)

The advantage of the thermal treatment of metals in a vacuum over other methods of thermal treatment is that in this treatment there is no oxide layer and no contact between the surface and the environment. Extensive use has usually been made of electric vacuum furnaces, but for this investigation the process was refined by using a special loading flange. G.D.B.

N64-23900 Advisory Group for Aeronautical Research and Development, Paris (France) Structures and Materials Panel
MANUAL ON AGROELASTICITY! VOLUME III. PART III: PREDICTION OF AEROELASTIC PHENOMENA
W. P. Jones ed. (Natl. Phys. Lab., Gt. Brit.) [1963] 285 p refs

CONTENTS:

1. INTRODUCTORY SURVEY W. J. Duncan (Glasglow U.) 51 p refs

2. AN INTRODUCTION TO THE PREDICTION OF AEROELASTIC PHENOMENA E. G. Broadbent (RAE, Farnborough) 26 p refs

3. DIVERGENCE AND RELATED STATIC AEROELASTIC PHENOMENA F. W. Diederich (AVCO Corp.) 58 p refs

4. FLUTTER AND RESPONSE CALCULATIONS IN PRACTICE E. G. Broadbent 37 p refs

5. DIAGNOSIS AND CURE OF FLUTTER TROUBLES J. C. A. Baldock and Ll. Niblett (RAE) 16 p

6. GENERAL DYNAMIC STABILITY OF SYSTEMS WITH MANY DEGREES OF FREEDOM A. I. van de Vooren (Groningen U., Neth.) 34 p refs

7. A SUMMARY OF THE THEORIES AND EXPERIMENTS ON PANEL FLUTTER Y. I. B. Fung (CIT, Pasadena) 47 p refs

N64-23958 Air Force Systems Command, Griffiss AFB, N.Y. Rome Air Development Center
SURVEY OF GROUND RADOMES
Robert B. Curtis May 1964 29 p
(RADC-TDR-64-127; AD-601661)

This supplemental survey presents a summary of the more cogent physical and operational characteristics of those rigid ground radomes developed since publication of the original survey in May 1961. Author

N64-23966 Rensselaer Polytechnic Inst., Troy, N.Y.
STRESS CORROSION CRACKING Interim Report No. 3
N. D. Greene and G. A. Saltzman 1 Jun. 1964 34 p refs
(Contract DA-30-069-ORD-3077)
(AROD-2721-4; AD-442235)

Cold work markedly decreases the corrosion resistance of steel in acid solutions. This effect was studied by electrochemical measurements and weight loss tests on zone-refined iron and carbon steels is exposed to sulfuric and hydrochloric acids. The mechanism of this phenomenon is discussed in detail. Author

N64-24073* Aeronutronic, Newport Beach, Calif.
STRUCTURAL BEHAVIOR OF COMPOSITE MATERIALS
Stephen W. Tsai Washington, NASA Jul. 1964 69 p refs
(NAS7-215)
(NASA-CR-71) OTS: $1.00

This study is concerned with the analysis of the structural behavior of composite materials. It is shown that composite materials can be designed to produce a wide range of mechanical properties. Thus, a structural designer now has at his disposal an added dimansion in optimum design—the materials optimization. Two types of composite materials are investigated: the undirectional fiber-reinforced composite and the laminated anisotropic composite. Analytical relations are derived between the composite material coefficients and the geometeric and material parameters of the constituents. Test specimens made of filament-wound materials are used. The experimental results show that the relations derived in this study are more accurate than existing theories, which include the netting analysis. Author

N64-24121 Aeronutronic, Newport Beach, Calif. Research Lab.
STRUCTURAL BEHAVIOR OF COMPOSITE MATERIALS Second Quarterly Technical Report, 14 May–14 Aug. 1963
S. W. Tsai 24 Aug. 1963 28 p refs
(Contract NAS7-215)
(NASA-CR-56343; U-2244) OTS: $2.60 ph

Work was concentrated on the theoretical prediction of the mechanical constitutive equation of laminated anisotropic plates, with special emphasis on cross-ply and angle-ply composites. The material coefficients are expressed as functions of lamination parameters. Author

N64-24137 Michigan U., Ann Arbor Radiation Lab.
MINIMIZATION OF THE RADAR CROSS SECTION OF A CYLINDER BY CENTRAL LOADING Scientific Report No. 1
Kun-mu Chen and Valdis V. Liepa Apr. 1964 105 p refs
(Contract AF 19(628)-2374)
(Rept.-5548-I-T; AFCRL-64-356; AD-601576)

This report develops a theory to explain the behavior of the cross section of a cylinder with loading and determines the optimum loading. The problem is studied by considering the currents induced in a body illuminated by an electromagnetic wave. The effect of central load of the cross section of a resonant and an antiresonant cylinder is carefully studied theoretically and experimentally. It was found that the scattering cross section of a resonant cylinder can be reduced more than 30db by an optimum loading. J.R.C.

N64-24151 Space Technology Labs., Inc., Los Angeles, Calif. Engineering Mechanics Dept.
TABLES AND CHARTS OF THE LOADING RATIO OF THE SHOCK RESPONSE OF A NONLINEAR SYSTEM
Y. C. Fung and R. N. Schreiner [1960] 79 p refs
(EM-10-23; STL/TR-0000-19362)

In the present report the loading ratio for a mass-spring system, in which the spring is nonlinear but elastic, and is of a softening, cubic type, is studied numerically. Tables and charts related to two families of forcing functions are given. One family of forcing functions has a nonvanishing total impulse. A particular set of such pulses is the positive-sine pulses, each member of which consists of two sinusoidal arcs with various rise and decay times. The other family of forcing function has a zero total impulse, but has a nonvanishing first moment. A single wave of sinusoidal function of time belongs to this family, and is called a double-sine pulse. The similarity and differences in the shock response characteristics of a linear and a nonlinear mass-spring system to these families of pulses are discussed. Data concerning systems subjected to a forcing function with exponential decay, with nonvanishing total impulse; and a double-square-wave, with zero total impulse but nonvanishing first moment are also presented. Author

N64-24179 J. G. Engineering Research Associates, Baltimore, Md.
THEORETICAL CALCULATIONS FOR RADIATION FROM LOBAR MODES OF CYLINDRICAL SHELLS UNDER POINT LOADING
Joshua E. Greenspon Feb. 1964 17 p refs
(Contract Nonr-2733(00))
(TR-9; AD-601182)

Using the anisotropic shell theory of Flugge as a basis, the vibration and sound radiation from stiffened and sandwich cylindrical shells under point loading are analyzed. The general theory of force oscillations of a three-dimensional elastic solid is applied along with the general theory of Love. J.R.C.

34 STRUCTURAL DESIGN

Includes structural elements; and weight analysis. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 33 Stresses and Loads.

N64-22894 Forest Products Lab., Madison, Wis.
METHODS FOR EVALUATING SHEAR STRENGTH OF PLASTIC LAMINATES REINFORCED WITH UNWOVEN GLASS FIBERS
Karl Romstad May 1964 37 p refs
(Contract AF 33(659)-63-358; BuWeps Order 19-64-8004-WEPS)
(FPL-033; AD-600860)

Several methods were employed to evaluate the shear strength of plastic laminate panels 1/8 in. in thickness and reinforced with unwoven glass fibers. Shear values at 0° to the fibers obtained by the Johnson shear and block-shear methods showed relatively good agreement. Shear strength values

at 0° to the fibers obtained from axial tests on notched specimens depended on the shear length between notches and the type of lateral restraint. Values obtained from short-span beam tests were affected by combined failures, depending on the shear span-depth ratio and the method of loading. Shear strength values at 90° to the fibers by the block-shear method were about two-thirds of values obtained by the Johnson shear method and by compression tests of double-notched specimens with 1/8 in. between notches. Because of the stress concentrations that develop in each of these test methods, none of the methods discussed give shear strength values as high as occur in pure shear. Author

N64-23077 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CALCULATIONS OF CYLINDRICAL AND PRISMATIC SHELLS BY THE METHOD OF DISCRETE UNKNOWNS
N. I. Gur'yev (Khar'kov Aviation Inst.) *In its* Bull. of Higher Educ. Inst. (Selected Articles) [1963] p 148–150 (See N64-23066 16-03)

An engineering method is proposed for calculating thin-walled shells having cross sections of arbitrary shape (open and closed, long and short), with constant or variable thickness of the skin over their contour. It can also be extended to reinforced and nonreinforced panels. The method consists essentially of the following. In the transverse direction, the model for the calculation of the shell is assumed to be discrete; i.e., for a transverse ring of the shell of width *dz* a finite number of degrees of freedom are assumed, and in the longitudinal direction this number is assumed to be infinite. The state of stress is approximated in the following forms: (1) a fundamental state determined from the elementary theory of thin-walled structural tubing; and (2) an additional self-balanced state, which is studied by an energy method with the help of the Castigliano principle of variations. Author

N64-23164 Naval Missile Center, Point Mugu, Calif.
SUMMARY OF DESIGN MARGIN EVALUATIONS CONDUCTED AT THE U.S. NAVAL MISSILE CENTER
C. V. Ryden *In* Defense Dept. Shock, Vibration and Assoc. Environments, Pt. 4 Mar. 1964 p 209–217 refs (See N64-23151 16-01)

Incremental levels of environmental stresses are applied to missile systems to induce failures deliberately. It is assumed that those components that fail are the weakest link in the structure. Improvements to missile reliability on the basis of such test programs will be discussed. Author

N64-23691 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEWS OF SCHOOLS OF HIGHER EDUCATION, AERONAUTICAL ENGINEERING (SELECTED ARTICLES)
28 Oct. 1963 32 p refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zavedeniy, Aviats. Tekhn. (USSR), no. 4, 1962 p 57–78
(FTD-TT-63-813/1+2; AD-426398)

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1. DESIGNING STRUCTURALLY ORTHOTROPIC SHELLS OF REVOLUTION Ye. F. Burnistrov p 1–12 refs (See N64-23692 16-34)
2. EQUATIONS OF EQUILIBRIUM AND OSCILLATIONS OF THREE-LAYER SHELLS M. T. Il'gamov p 13–27 refs (See N64-23693 16-33)

N64-23692 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DESIGNING STRUCTURALLY ORTHOTROPIC SHELLS OF REVOLUTION
Ye. F. Burnistrov *In its* News of Higher Educ., Aeron. Eng. 28 Oct. 1963 p 1–12 refs (See N64-23691 16-34)

Asymptotic concepts of Bessel's and Hankel's functions are used to find a solution for structurally orthotropic shells of revolution. In particular, results are obtained for a multilayer shell with an odd number of orthotropic layers and for a two-layer shell with isotropic layers. P.V.E.

N64-23727 Aeronutronic, Newport Beach, Calif.
TELESCOPING PRESSURIZED STRUCTURES AND SEALS
W. Bandaruk, D. G. Younger, and N. E. Quackenbush *In* AFSC Aerospace Expandable Struct. Mar. 1964 p 548–575 refs (See N64-23701 16-01)

In a study of telescoping structures having hermetic integrity, four telescoping concepts are advanced that incorporated relatively elementary sliding movements adaptable to mating sections of rigid construction. In each design, teflon rollers are included at the section terminals to insure both a smooth, low-resistance telescoping motion and a medium for transmitting bending moments that may develop during expansion. At full deployment, each of these designs embraces a means for transmitting mechanical loads. J.R.C.

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